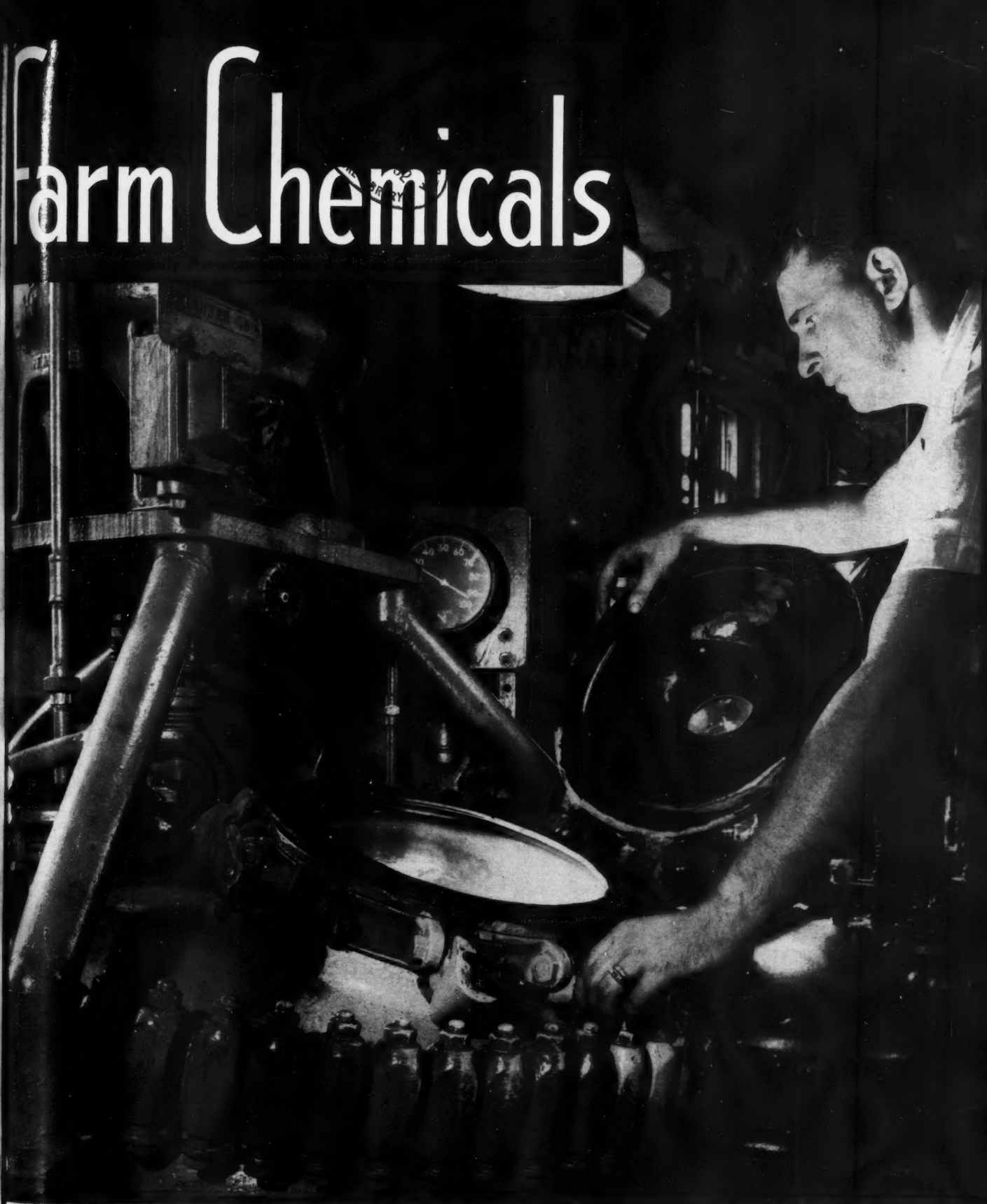
Farm Chemicals



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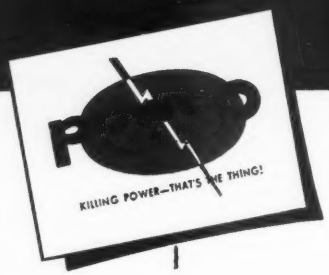

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In this issue . . .

Startling news that infinitesimal quantities of antibiotics can cause a significant stimulation in the growth of sweet corn and other plants was given the industry last month by a research head at Chas. Pfizer & Co. Terramycin, penicillin and other antibiotics, with amazing performances in combatting widespread diseases already to their credit, now enter the field of farm chemicals. See story and pictures on page 12.

Records, records, records . . . that has been the rule in meetings of the industry this year. Earlier in the summer NFA and the American Plant Food Council set attendance records at their annual gatherings. Last month at Spring Lake, N. J., the National Agricultural Chemicals Association joined the list when more than 500 attended the 19th annual meeting. For a report and photographs, see our account on page 14. FARM CHEMICALS includes the complete report of Dr. H. H. Shepard on domestic pesticide requirements for the 1953 season on page 31 and an abstract of President Mohr's address on page 38. We comment editorially on the annual report of Lea Hitchner, executive secretary of NAC, in our new editorial location on page 76.

FARM CHEMICALS ***gets requests*** for reprints of articles quite frequently but this month we were really surprised. We got a request for reprints of Dr. K. D. Jacob's paper on Phosphate Fertilizers for Western Agriculture—before this issue had been printed! For the excellent report on the subject turn to page 21.

We have always been interested in how various fertilizer and pesticide companies got started in the field—in their problems, progress and techniques. That's why we are starting a series of plant stories in this issue. We'll have more in future issues, about plants both big and small. For the first (on Federal Chemical Company) turn to page 36.

An important step toward insuring that a pesticide will do the same job in one part of the country as it will in another was taken recently by DuPont. Read the story of their unique experiment station on page 46.

When the American Chemical Society met last month in Atlantic City, N. J., widespread interest centered around the papers presented in our industry. This month we include abstracts of papers concerning fertilizer and pesticides on page 49. We'll print the remainder in the November FARM CHEMICALS.

Grass as an important user of fertilizers and pesticides really is booming these days because of the grasslands movement. Read the short article about the recent Grasslands Congress on page 75.

farm chemicals

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PIONEER JOURNAL OF THE FARM CHEMICALS INDUSTRY

Vol. 115 **OCTOBER, 1952** **No. 10**

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Cover Story

A new use for the well-known antibiotic, Terramycin, was announced this month with the report that it has value as a plant stimulant (story page 12). Cover photo shows reaction vessel used in Terramycin recovery at Brooklyn plant of Chas. Pfizer & Co., Inc.

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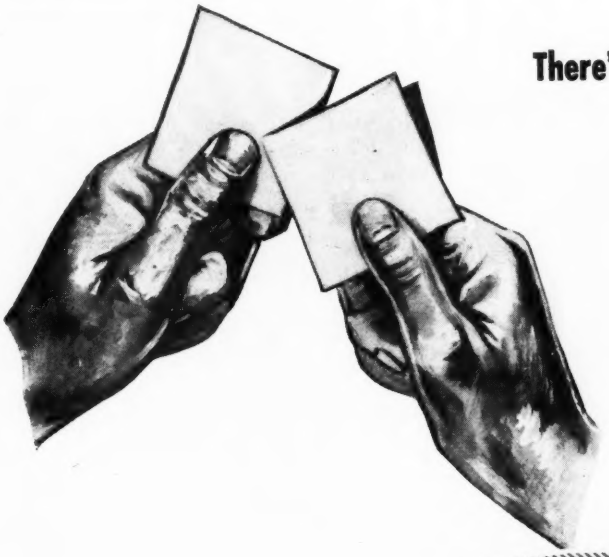

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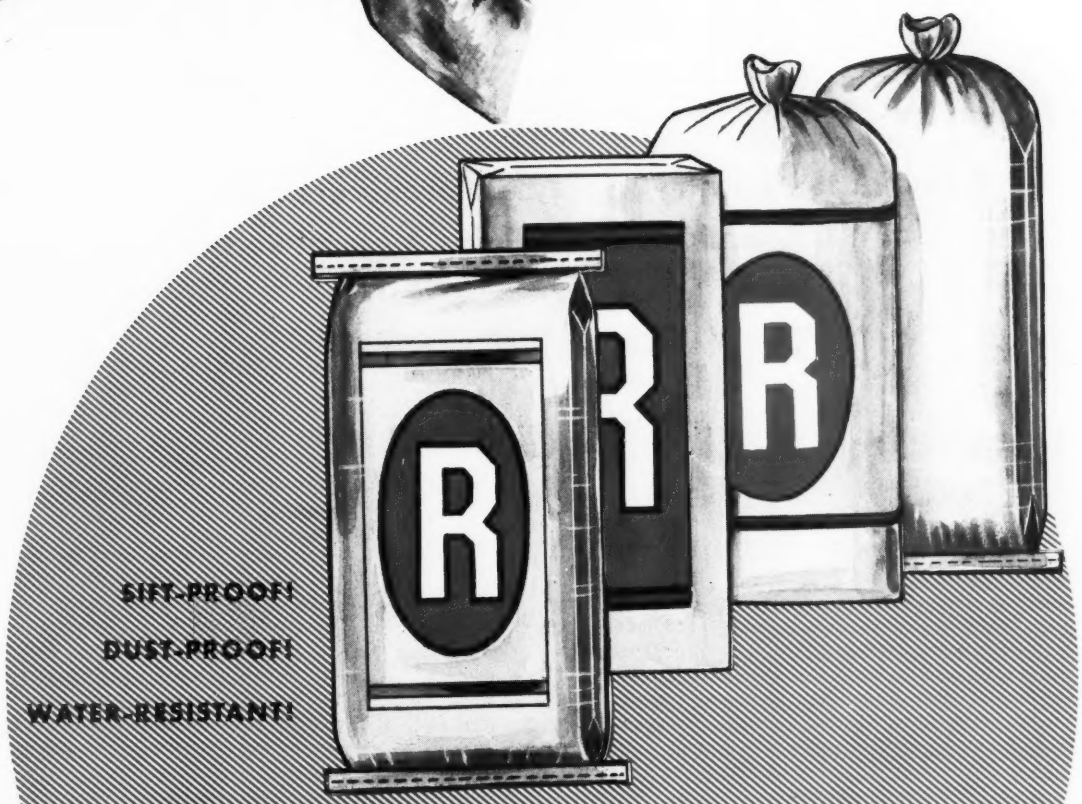

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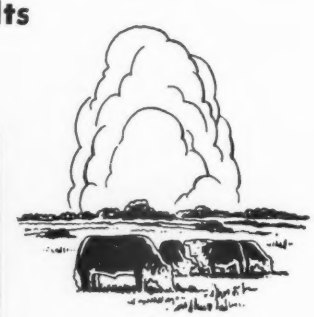

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farm chemicals facts

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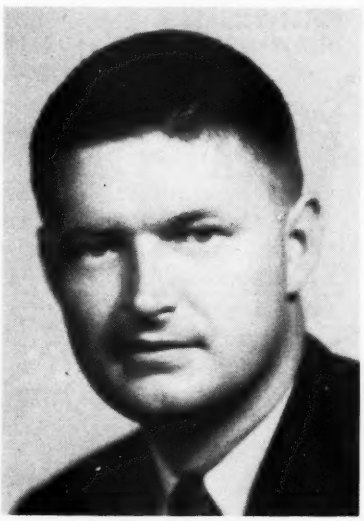
Hercules Appointee



Henry F. Pierce

Hercules Powder Co. has appointed **Henry F. Pierce** to represent the company's agricultural chemicals section in New Mexico, Arizona, southern California and the west coast of Mexico. An entomologist, he will be headquartered in the Hercules Los Angeles office.

Monsanto Chemical is reported as interested in Detergents, Inc., Columbus, Ohio. It has been hinted that a merger may be in the offing. Only product of the Columbus firm, at present, is a detergent recommended for use in automatic washers.

A 35 million dollar loan at 3⅞ per cent interest has been obtained from four insurance companies by W. R. Grace & Co. The thirty year loan is earmarked for an expansion program with special emphasis on production of chemicals.

A progress report on Krilium tests has been released by Monsanto Chemical. It discusses economics of Krilium and describes several specialized farm applications that show promise. Copies are available from the Merchandising Division, Monsanto Chemical Co., St. Louis 4, Mo.

Ammonia production at Nitrogen Division, Allied Chem. & Dye's South Point, O. plant will be increased through construction of a new methanol plant. When the new facilities are completed a production unit formerly used for methanol production will be made available for the manufacture of ammonia. The unit is scheduled for completion next spring.

Davison Chemical Corp. has announced election of Walter L. Price as a director of the company. Vice president in charge of accounting and freight claims for the B & O railroad, he fills the vacancy created by the resignation of R. L. Snodgrass.

Benjamin Elsas, former president and board chairman of Fulton Bag & Cotton Mills died August 26 after a five month illness. Mr. Elsas became president of the company following the death of his brother in 1924. After retiring as president he served as chairman of the board before assuming duties as chairman of the executive committee. He held the latter position at the time of his death.

A. J. Garon has been named manager of the Houston, Tex. area for Julius Hyman & Co. Garon has been with Shell Chemical for seven years and since July 1950 served as technical salesman in the Houston area. The Houston office will be located at 1601 Melrose Building.

CBP-55, new soil fungicide developed by Julius Hyman & Co., soon will be in production at the company's Denver plant. The material has been very effective when used in tobacco seed beds and for control of root-rots of strawberries and nursery stock. Pilot plant stocks are adequate for fall supplies and the production schedule assures availability of CBP-55 for large scale spring treatments.

President of Calabama Chemical Co., Mr. Harold C. Davies, has been elected to the Board of John Powell Chemical Co. Calabama produces DDT and other compounds which are processed and marketed through the Powell organization.

New West Coast plant for production of farm chemicals and other products is expected to go into production around the first of November. American Chemical Paint has announced the acquisition of office and plant facilities at Niles, Cal. and has named George H. Williamson to head up the new branch. Field representatives will provide technical servicing and consultation for West Coast customers.

Appointment of two new district managers has been announced by Davison Chemical's Mixed Fertilizer Div. Effective Sept. 1 George Klein was assigned to a Nashville, Tenn. post and Bernard C. Manker to Lansing, Mich. Klein will be in charge of plants serving the south and areas west of the Mississippi and Manker heads up those serving the midwest.

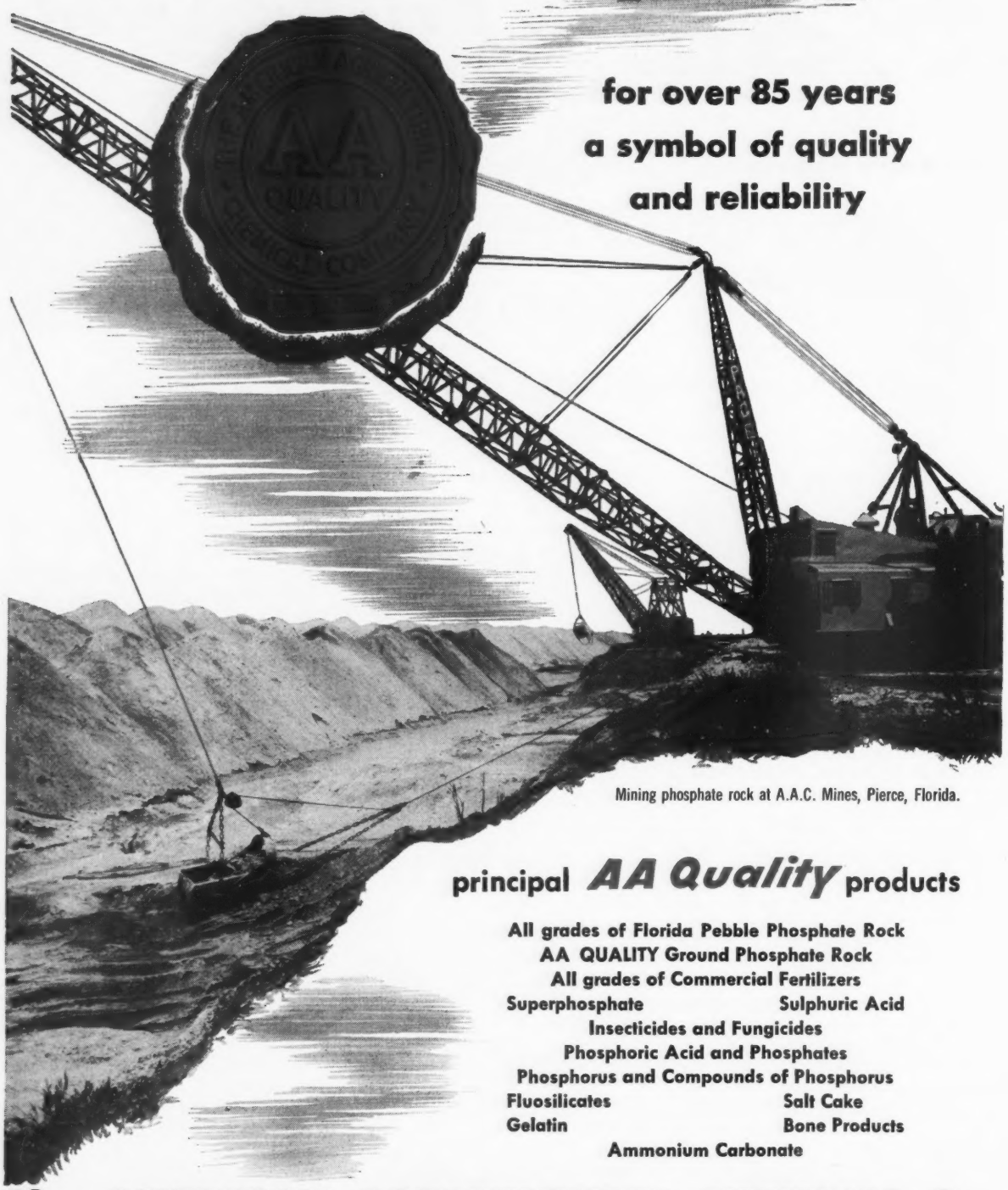
Both men have spent 35 years in the fertilizer industry. Klein has been with Davison or predecessor companies for 31 years and Manker began with Armour Fertilizer, then moved to Michigan Fertilizer until 1951 when he joined Davison after their acquisition of the Michigan plant.

Leon A. Kolker, founder and former president of Kolker Chemical Works, retired Aug. 31. Company activities of the Diamond Alkali subsidiary now are carried on by J. G. Brunton, in charge of sales and Charles H. Kolker, in charge of operations and engineering. Their functions will be coordinated under A. L. Geisinger, Diamond Alkali vice president in charge of the Organic Chemicals Division.

A new organic section to develop and manufacture a line of organic chemicals and related products has been formed by the **Solvay Process Division,** Allied Chemical & Dye Corporation. **Dr. C. S. Fazel** was appointed a vice president of Solvay to head the section. First project of the organic branch will be construction of a plant to manufacture ethyleneglycol and ethylene oxide.

William B. Gardner has joined **Pennsalt** of Washington as sales-service representative in the agricultural chemicals division. Gardner's territory will include California, Arizona and New Mexico.

AA Quality...



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farm chemicals outlook

Report from Washington
by Fred Bailey & John Harms

The future of the pesticide industry is as "bright as a prewar silver dollar in prewar days." While the industry will continue to be harassed by inherent difficulties, such as on-again, off-again weather and insects, generally the picture is bright.

That is the sum of opinion expressed to us by industry leaders and government men here in Washington.

This, bluntly, is what they say: The pesticide market is "ruled by bugs . . . insects are harsh dictators." It's time the industry took more of the element of chance out of its market. They ask: Why should an industry as big as pesticides lay success or failure on whether bug infestations will be heavy or light next year?

You can never take all the chance out of the market . . . they readily admit. But there are many things you can do to cut out the peaks and valleys in the market . . . get more stability. These include:

At home—Educate your customer . . . the farmer. Practical demonstrations, personal contacts still are best sales methods.

The government—Use it. The government, USDA, with its production and information programs can give you more mileage educationally and sales-wise. Such programs as the production goals and the storage operations are made to order for promotion material.

Abroad—Do a bigger selling job abroad . . . most areas are undersold on pesticides. Also, where sulfur pesticides are used, introduce substitutes.

Research—If you can afford it . . . do more of it and along new lines. There now are more insect pests than ever before . . . despite the fact that pesticides are better. Remember that insects destroy more than $4 billion every year.

Practical farm use of systemic insecticides still is a long way off. Little chance that much, if any, will be on the market in 1953. Private and government research both are considered too deep in basic testing phases.

Before systemics can go to market many questions still must be answered. Such as: Are residues harmful to man and animal life in crop? Just what residues are left? Will they effect the natural chemical properties of crops? What legal difficulties will arise? Other problems being worked on are correct dosages, methods and time of application and cost.

Considerable success is being made with organic phosphate compounds as systemics to combat the cotton pink bollworm. Entomologists at the Brownsville, Tex., Experiment Station are screening hundreds of chemical compounds for possible use as systemic insecticides. Twelve organic phosphate compounds have proven successful.

Forecasts of pesticide requirements for the next season when made in the fall are more a matter of "feel" than fact. You don't have the benefit of over-winter bug surveys, nor do you know how severe the winter will be.

But USDA, for the first time this year, has made such a survey . . . and it's necessarily tentative. The forecast is based on (1) reports of production and inventory position received from industry, and (2) State estimates of the expected percentage shift in usage during the following crop year.

Tentative estimates are made under possible conditions of lightest and heaviest

bug infestation. For the big ones, USDA predicts:

DDT. Between 70 and 85 million lbs. In 1950-51 domestic consumption was about 79 million.

Benzene Hexachloride. In terms of 12 per cent technical BHC, 79 million lbs., and 95 million. In 1950-51 it was 80 million.

Aldrin, Chlordane, Dieldrin, Heptachlor, Toxaphene. Lumping them together, USDA figures between 5.5 and 6.5 million lbs.

Lead arsenate. Between 20 and 30 million lbs. In 1950-51 it was about the latter figure.

Calcium arsenate. Between 15 and 40 million lbs. In 1950-51 it was 39 million.

Sulfur, ground. Between 423 and 356 million lbs. In 1950-51 it was about 530 million.

Copper sulfate. For both direct use and derivatives, between 90 and 105 million lbs. In 1950-51 it was about 100 million.

Dithiocarbamates. About 20 million lbs.

2,4-D. Between 28 and 32 million lbs. Up from 24 million in 1950-51.

2,4,5-T. More than 5 million. It was 2.8 million in 1950-51.

The government is to play a much bigger role on the research and selling ends of the fertilizer business from now on. The USDA-sponsored "fertilizer and lime utilization program" finally is getting off the ground . . . after months of delay.

But officials will be playing down the facts USDA is helping "sell" fertilizer . . . play up ends, not means. USDA is going all out to guide farm use of more fertilizer to the end that production can be increased on present acres.

Utilization Program steering committee, headed by W. A. Minor, assistant to the Secretary of Agriculture, has outlined a broad research and educational program to increase wise utilization.

Research, industry, federal and state government agencies interested, TVA and others will be brought in on a coordinated, cooperative basis.

Pressing research includes: On overcoming the limiting effect on fertilizer output of the sulfuric acid shortage . . . cutting costs between producer and consumer . . . developing uniform agreement on proper fertilizer placement . . . developing more and better placement equipment.

All-out government publicity will serve the program . . . including the vast PMA committee system which reaches into every farming community in the country. Local field demonstrations are to be used widely . . . with industry possibly supplying the fertilizer materials.

"Full and continuing cooperation" is to be asked of the fertilizer and lime industries to coordinate their efforts with the fertilizer and lime utilization program.

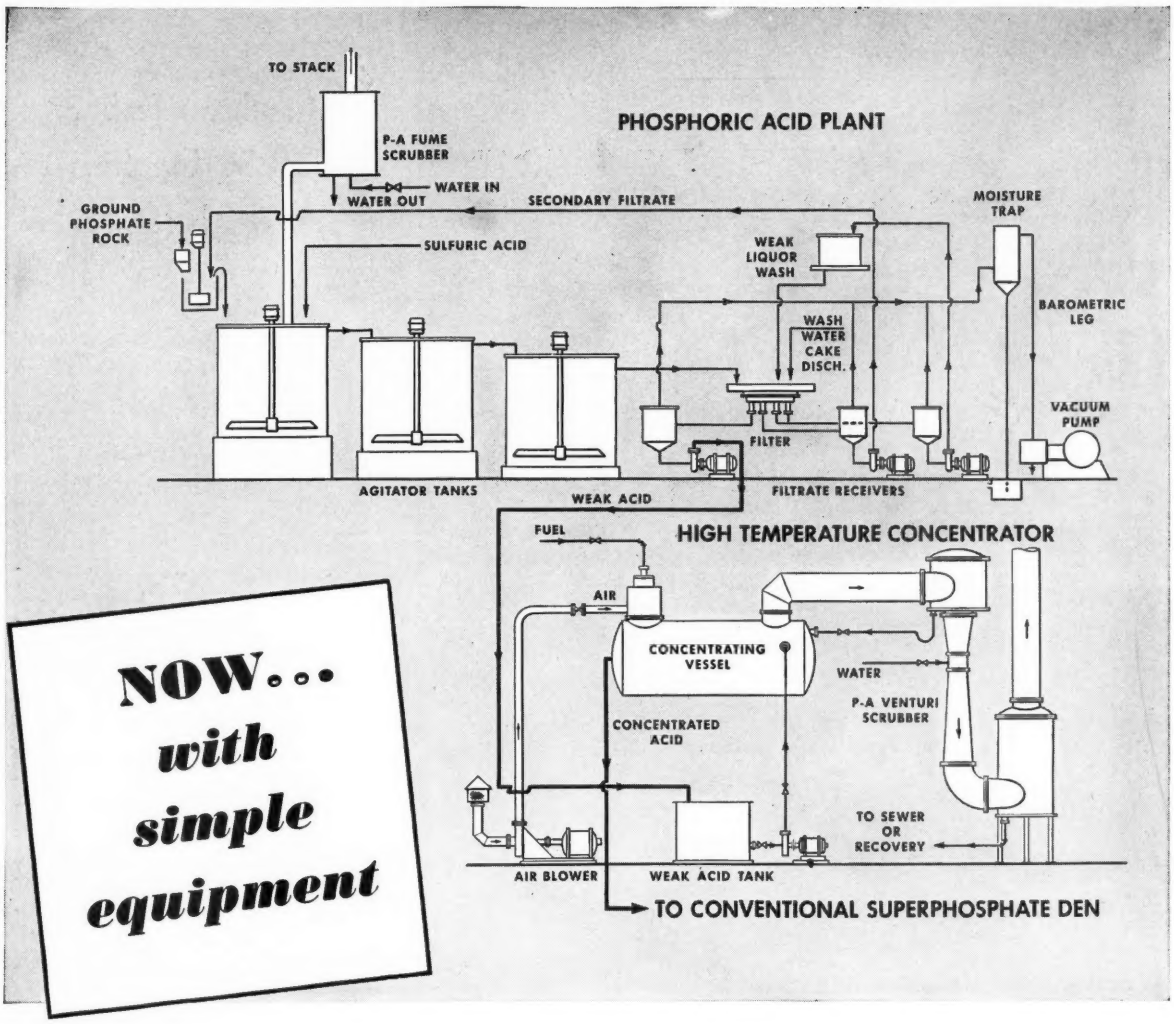
Government officials see in the new program great potentials for increasing production of farms to meet the needs of the growing population. They are sold on the idea that fertilizer is the most important single factor in boosting production.

Availability of fertilizer supplies for the 1952-53 season, and others, is estimated thus by USDA:

Nitrogen. 1.6 million tons, 123 per cent of 1950-51 supplies of 1.3 million. USDA estimates supplies of 1951-52 at 1.4 million tons. Estimate for 1953-54 is 1.9 million, and for 1954-55 it's 2.2 million tons.

Phosphates. 2.5 million tons, 110 per cent of 1950-51 supplies of 2.2 million. Supplies for 1951-52 are estimated at 2.2 million, same as previous year. No estimate is made for the next two years because expansion program has just begun. Also, because of uncertainty surrounding sulfur-sulfuric acid supply picture.

Potash. 1.85 million tons, 128 per cent of 1950-51 supplies of 1.4 million. Supplies for 1951-52 are estimated at 1.6 million. Estimate for 1953-54 is 1.9 million, and for 1954-55 it's 2.2 million.



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Farm Chemicals

Staff Report

SURPRISES have come thick and fast in the field of antibiotics which was started only a decade ago, but it is doubtful that anyone in the farm chemicals industry knew that the next one would be in his field.

We have come to take news of the wonderful performance of such antibiotics as penicillin, streptomycin and terramycin in safeguarding humans from the once terrifying effects of many diseases more or less in our stride. Now comes announcement of preliminary experimental work which indicates a direct application of these antibiotics in the industry.

Earlier Use

Actually the jump wasn't as big as all that. Terramycin came into the agricultural field some months ago when antibiotic supplementation of hog and poultry feed caused a barnyard revolution on American farms.

Now comes news that it and several other antibiotics may have value as plant stimulants—when applied in infinitesimal quantities.

Announcement of the new use was made in mid-September at the annual meeting of the American Institute of Biological Sciences at Cornell University. It was given in a paper read by Dr. Louis G. Nickell, head of the phytochemistry laboratory of Chas. Pfizer & Co.,

Top: Ten grams of Terramycin are heaped in this hand. Bottom: Sterile packaging line, end of the production trail for the microscopic mold spore.

TERRAMYCIN *as a plant stimulant*

makers of terramycin, who told of the action of minute quantities of the chemical as a stimulant in the growth of corn and other plants.

Obviously the discovery could have widespread importance to agriculture, particularly for those areas of the earth where the growing season is too short.

Dr. Nickell's paper, called "Plant Stimulation by Antibiotics," is the result of experiments he has been conducting since 1948.

Three Types

"Data from three types of experiments have shown a stimulation of plant growth by antibiotics: tissue culture, standard laboratory seed germination and seed germination and subsequent germination in soil," the paper states.

Dr. Nickell summarizes his experiments with the statement that antibiotics may have a "practical application in the stimulation of plant growth as well as in the control of plant diseases. The use of tissue culture techniques should prove a useful tool in the study of the mechanism of stimulatory action by antibiotics."

Growth responses occurred when plants were given certain antibiotics in concentrations as low as one part antibiotic per million parts water. He added that the chemicals increased percentage seed germination.

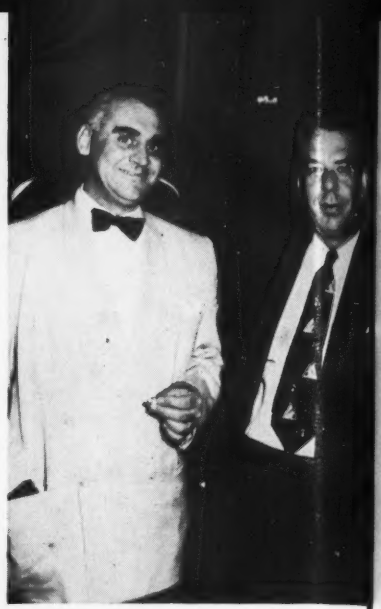
Dr. Nickell described the sweet corn experiments:

He planted 49 seeds in each of two greenhouse flats. Growing conditions were identical, but one flat was watered once each day for four days with one liter of tap water containing terramycin in a concentration of five parts per million parts of water. Thereafter, the plants were watered as needed. Seeds in the second flat were given the same amount of water, with no antibiotic.

After four weeks, average height for corn given terramycin was 17.45 inches, untreated—14. Corn above ground in the terramycin flat weighed 45 grams, he reported, while untreated weighed 23 grams. Plants of both groups were dried with the result that the treated group weighed 5.1 grams and untreated 2.4 grams, indicating, according to the chemist, that the gains represented were true growth responses, not merely increased water absorption. Increased germination also was noted in the treated flat.

When terramycin treatment is stopped completely at an early stage, growth continues, Dr. Nickell said tests with sorrel showed. Other experiments on radishes indicated that when two of the more stable forms of penicillin (procaine and diamine) were mixed in soil at a rate of 10 units per gram of soil, radish plants averaged from almost twice to almost three times as large as untreated radishes. Stimulation also was gained with streptomycin and thiolutin. ◆

In the production of antibiotics, soil samples are received constantly from all parts of the world. Here women technicians prepare Petri dishes for the implantation of molds in the Pfizer company mycology research laboratory.



Left: E. W. Cannon and Russell Dorman, Calif. Spray-Chemical Corp. and R. H. Beatty, American Chemical Paint Co. Center: L. Lykken, Shell Chemical Corp., Leo R. Gardner and T. W. Reed, Calif. Spray-Chemical Corp.; Right: L. S. Kaniecki, Tennessee Corp. and M. C. Van Horn, Florida Agricultural Supply Co.

With record attendance . . .

NAC Marks Progress

By Hamilton C. Carson

Managing Editor

The complete text of Dr. H. H. Shepard's talk on domestic pesticide requirements for the 1953 season appears on page 31. An extract of President Arthur W. Mohr's address is included on page 38. For editorial comment on Lea Hitchner's annual report, see the last page of this issue.

"PROGRESS" wasn't billed as the theme of the 19th annual meeting of the National Agricultural Chemicals Association last month in Spring Lake, N. J., but it might well have been.

For throughout the three-day sessions in the Essex and Sussex Hotel Sept. 3–5, on the Atlantic Ocean front, there was a prevailing atmosphere of optimism concerning pesticides.

This despite one of the poorest sales years for the industry since World War II, especially in cotton states.

Everywhere—in the formal NAC meetings, in the lobbies of the Essex and Sussex and the Monmouth Hotels (where the overflow delegates were housed) and at social functions—there was continual discussion about progress of the industry.

Conversations about new products, processes and expansion were frequent during the sessions. Outlook for future export markets to help level the economy and prevent periodic sales slumps was considered at length in a panel on exports at the closing meeting in the ball room of the Essex and Sussex, headquarters for the gatherings.

Recent Poor Season

The headaches and disappointments of the recent poor season weren't forgotten, however, as several speakers from government and industry put forth suggestions which they believed would combat future slumps and aid in the forward movement of the industry which has been mushrooming in recent years.

Industry personnel long have known that it would be good business to expand the manufacture of pesticides to control more pests in all areas of the country. The importance of expansion from the standpoint of national economy was brought home forcefully by W. A. Minor, assistant to the secretary, U.S.D.A., who used the widely discussed "Fifth Plate" as basis for his talk.

Minor cited figures on the increasing population trend in the United States and the necessity of producing more and better farm chemicals to fight pests and diseases which annually threaten crops.

Referring to the chemical industry Minor declared "we have increased production 50 per cent in less than

20 years with the help of the chemical industry that, agriculturally speaking, has barely gotten its feet off the ground."

President Arthur W. Mohr, president of California Spray-Chemical Corp. opened the first day's session with a resume of NAC activities during the past year. (*See page 38.*)

In its attempts to provide food for the "Fifth Plate," a warning was issued to delegates by Dr. G. D. Humphreys, president of the University of Wyoming, that industry may be short 13,800 scientists by 1954.

Drop in Enrollment

Drop in college enrollments was given as the cause of the scientist shortage by the college president.

Dr. Humphrey discussed methods being employed to improve the supply of technical personnel and stated that colleges and universities are searching out students with natural ability in science and are encouraging these students to enroll in colleges.

He suggested establishment by business and industry of "an overall foundation to provide financial assistance to public supported educational institutions and their students."

Medical problems concerned with the aerial application of dusts and sprays were enumerated by Dr. Clair R. Spealman, chief of the Safety Projects Branch, Civil Aeronautics Administration.

Dr. Spealman discussed the qualifications of pilots for this work, saying that "because of the nature of the work, pilots engaged in agricultural flying should possess good physical and mental qualities."

"Agriculture's Role in the American Story" was the topic of a talk by Dr. Paul Sanders, editor of the Southern Planter.

Dr. Sanders credited the pesticide industry with making a major contribution to the American way of life and said "the Earth is the source of our strength."

He concluded with the assertion that if America is to remain strong in time of peace and invincible in time of war "we must maintain a large, prosperous and dignified farm population."

NAC delegates were given a detailed picture of domestic pesticide requirements for the 1953 season on the second morning of the convention, by Dr. Harold H. Shepard, staff specialist, Office of Materials & Facilities, PMA, USDA. (*See page 31.*)

In outlining the problem of agriculture and technological improvements, Oris V. Wells, chief of the Bureau of Agricultural Economics, U.S.D.A., said, "American agriculture is faced with the problem of maintaining continual technological improvement on the farm front, or gradually increasing production per acre, per animal and probably per man, over the years to come."

Difficulties encountered in use of pesticides which

Top: C. L. Smith, Ethyl Corp.; M. J. Janes, Socony-Vacuum Oil Co., Inc., L. P. Harris, Cotton States Chemical Co., Inc. and W. W. Sunderland, The Dow Chemical Co.; Center: Mr. and Mrs. L. G. Matthews, American Smelting & Refining Co., Mrs. Mark Biddeson, General Chemical Division and Mr. and Mrs. J. A. Rodda, U. S. Industrial Chemicals Co.; Bottom: R. H. Schneider and J. F. Kirk, General Chemical Division and Geo. W. Hall Jr., Chemagro Corp.

endanger the lives of beneficial species were discussed by Walter W. Dykstra, in another talk. He is assistant to the chief, Branch of Predator & Rodent Control, Fish & Wildlife Service, Department of the Interior.

Investigations concerning effects of DDT on fish and wildlife have provided findings that indicate none of the new potent poisons have created "biological deserts" as predicted by some persons, according to Dykstra.

One of the high points of entertainment at the convention was a rapid-fire talk by Gene Flack, sales counsel and director of advertising at Sunshine Biscuits, Inc.

The talk, which contained 113 funny stories, by rough count, also was sparked with valuable points on business and selling.

Ten Reasons for Optimism

Flack gave 10 reasons "to be happy" about the current business situation. He said there will be no recession "unless we talk ourselves into it" and stated that national income this year is seven per cent higher than last year, even after taxes.

A summary of "The BEPQ in 1952" was given by Avery S. Hoyt, chief of the Bureau of Entomology and Plant Quarantine.

Hoyt highlighted the year's activities in the department and concluded with this statement:

"We are continuing the effort to conserve sulfur by finding suitable alternate products; we are renewing our studies in biological control, particularly the use of diseases to control insect pests and, of course, we are continuing our efforts to find new and more effective insecticides. In some of these problems we are cooperating with you individually and believe results may be mutually beneficial."

Hoyt departed from his prepared text to issue a call for more information about insects.

"After all these years we know so little about insects with which we work," he said. He cited need for a "central testing laboratory to coordinate the efforts of groups doing research on insects and pesticides."

He added that a "better job of forecasting insect infestations and populations" is needed.

Residue Problems Unnecessary

There need never be a real residue problem in this country, Dr. George C. Decker declared in the concluding talk of the convention.

Dr. Decker, head of the section of Economic Entomology, State Natural History Survey Division, College of Agriculture, University of Illinois, said this would be true "if all individuals interested in the future of pest control could and would become fully familiar with the merits and limitations of the various pesticides available and resolve never to make or condone an unsound recommendation."

In the panel on exports which followed Decker's talk, delegates heard about the problems involved in shipping pesticides overseas from four industry and governmental leaders. A brief resume of their remarks follows:

Phillip H. Groggins, chief of the Agricultural Chemicals Section, Chemicals Division, NPA, U. S. Department of Commerce—Discussed "ways and means of stimulating and expanding our export markets," and concluded ". . . it appears that government programs alone, no matter how generously conceived, cannot do the job of improving the economic position of our friendly nations. Private enterprise can and should assume part of our burden. Members of the NAC should—if they have not already done so—develop their own Point Four programs."

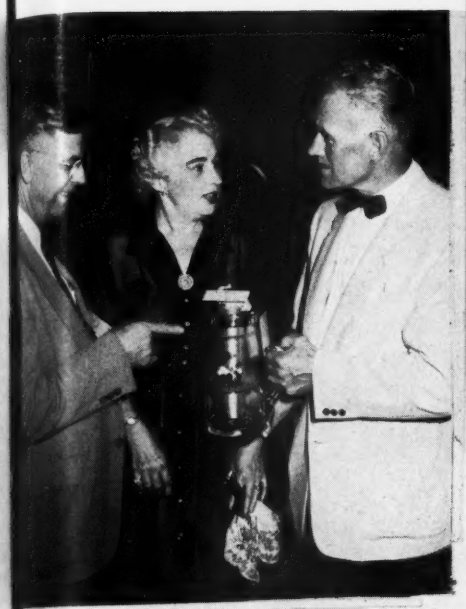
John H. S. Barr, vice president of Pennsalt International Corp.—In reference to proposed installation of DDT plants in four foreign countries, he stated, "I understand that one of the purposes for these DDT plants is to aid the industrial development of the countries. With possibly the sole exception of alcohol, none of the other raw materials for DDT is usually available at a reasonable price in countries which are not industrially developed. Therefore, it would appear that industrial development should come before the DDT plant in order that the final product might compete with DDT which already is available."

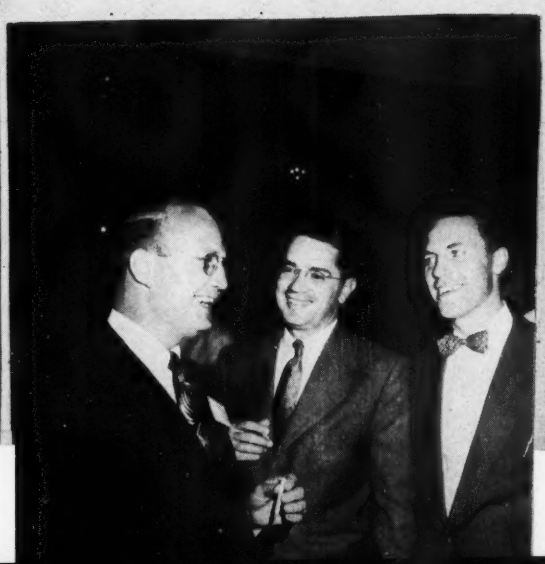
Earl R. Beckner, chief of the Chemicals and Semimanufactured Products Branch, Manufactured Products Staff, Office of International Materials Policy, State Department—Told about work of the Working Party on Insecticides, of which he was a member. The organization sought to determine the supply-demand situation for DDT and BHC and prospects for the next few years. He said the group found "there was no significant shortage of the pesticides at the time it met and no shortages were likely to develop."

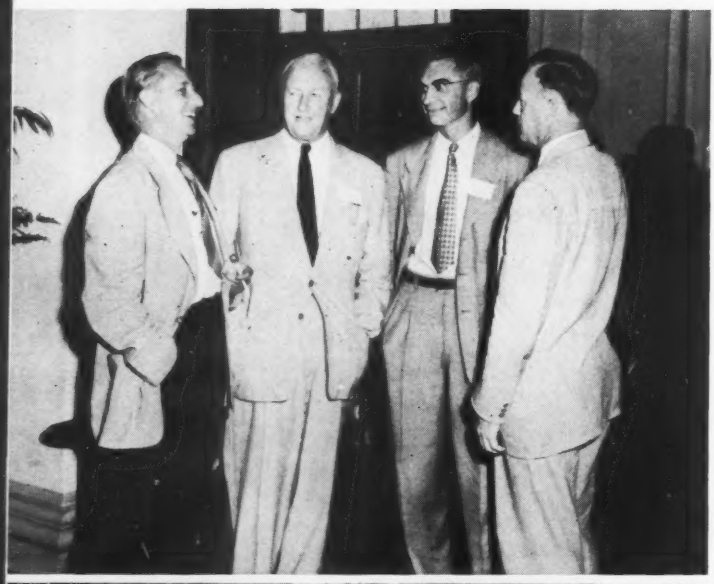
Dr. Ralph Stewart, director of Agricultural Prod-

Photos on Opposite Page

Center: Ann and Graham Thompson, daughter and son of Friar Thompson, Prentiss Drug & Chemical and Richard Shafer, son of James I. Shafer, B. G. Pratt; Clockwise, starting at upper left: Mr. and Mrs. C. C. Compton, Julius Hyman and M. J. Bunnell, Geigy; C. C. Johnson, Larvacide Products, Mr. and Mrs. Friar Thompson, Prentiss Drug & Chem., and Mr. and Mrs. L. G. Matthews, American Smelting and Refining; Mr. and Mrs. W. A. Smith, Jr., Riverdale Chemical; Phil Alampi, WJZ, Norris H. Evans, Cotton Trade Journal and F. H. Cappy, American Cyanamid; J. F. White, Julius Hyman, S. L. Calhoun, Agricultural Chemical Co. and W. M. Jarnagin, Attapulgus Clay; T. L. Bendall, Dow Chemical, C. D. Fisher, Carbide & Carbon Chemicals and A. F. Kingsbury Jr., Rogers & Hubbard; Mr. and Mrs. P. H. Groggins, N. P. A.; C. R. Winter, John Powell, Dr. H. D. Tate, Naugatuck Chemical Division, U. S. Rubber and W. T. McLaughlin, Pittsburgh Agricultural Chemical.







ucts Division, Office of International Trade, Department of Commerce—Mentioned export controls and said "we, like you, are looking forward to the time when they can be eliminated." Said export controls may become necessary in times of emergency but "we feel they should be held to a minimum and that controls for such nonstrategic commodities should be relaxed or removed entirely in line with improvement in the domestic supply."

Wallace S. Moreland, assistant to the president of Rutgers University, presided at the forum.

Social activities at the convention included a golf tournament, with John Roda in charge, a reception for members and guests and the annual banquet.

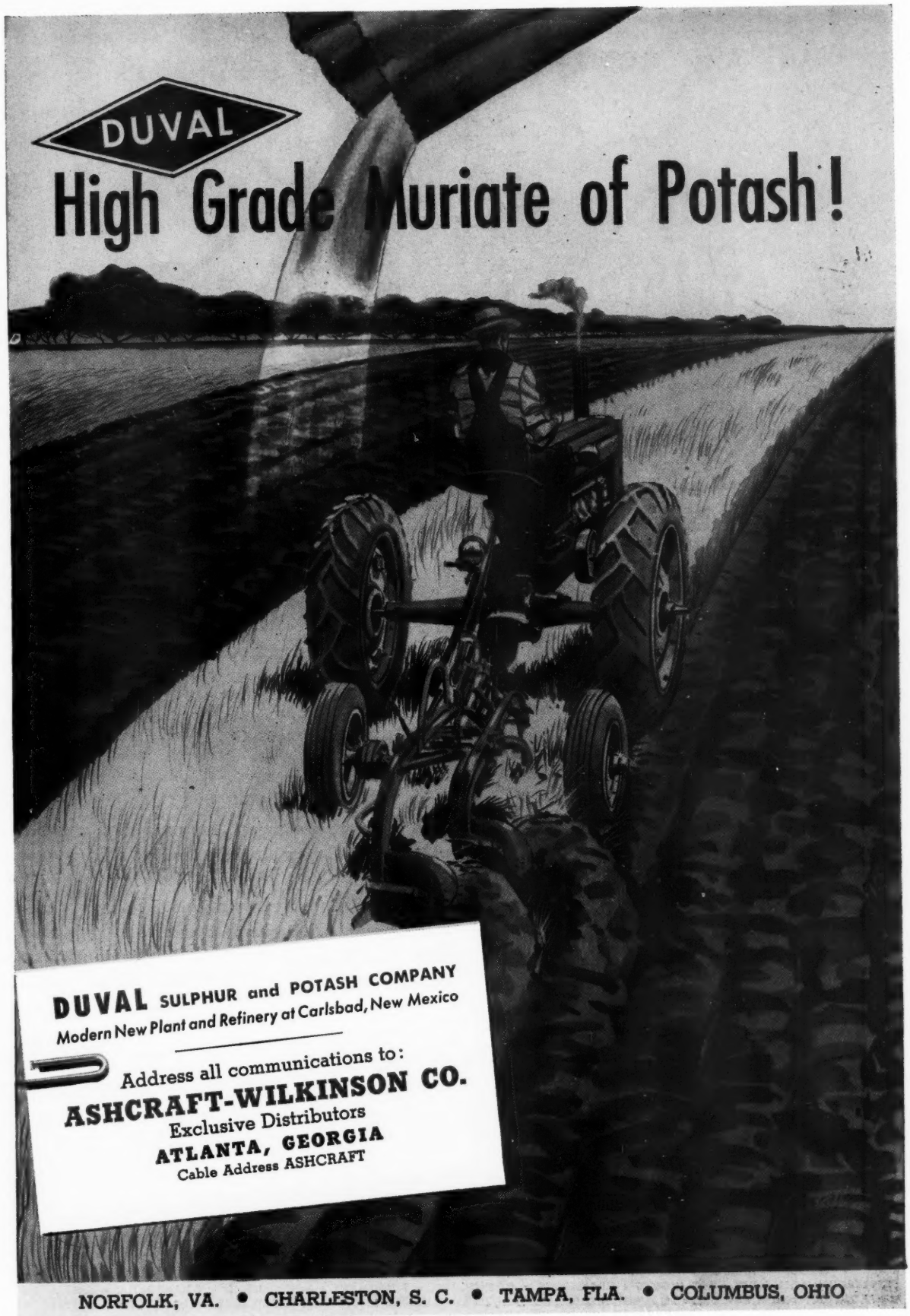
All officers of the organization were reelected for another one-year term at a meeting of the board of directors. In addition to Mohr as president, they are vice president, Paul Mayfield, general manager of the Naval Stores Dept., Hercules Powder Co., and executive secretary, Lea S. Hitchner. ◆

Elected to the board of directors for terms of one to five years were the following:

W. W. Allen, Mgr., Agricultural Chem. Sales, The Dow Chemical Company, Midland, Mich.; **W. C. Bennett,** Pres., Phelps Dodge Refining Corp., New York, N. Y.; **J. Hallam Boyd,** Exec. Vice-Pres., Commercial Chemical Co., Memphis, Tenn.; **F. W. Hatch,** Vice-Pres. and Manager, Julius Hyman Div., Shell Chemical Corp., New York, N. Y.; **John Paul Jones,** Asst. to Gen. Mgr., Stauffer Chem. Co., New York, N. Y.; **G. F. Leonard,** Exec. Vice-Pres., Tobacco By-Prod. & Chem. Corp., Richmond, Va.; **Paul Mayfield,** Gen. Mgr., Naval Stores Dept., Hercules Powder Co., Inc., Wilmington, Del.; **James McConnon,** Vice-Pres., McConnon & Company, Winona, Minn.; **A. W. Mohr,** Pres., California Spray-Chemical Corp., Richmond, Calif.; **August Petrus,** Pres., Cotton States Chemical Company, Inc., West Monroe, La.; **E. H. Phillips,** Dir. of Purchasing, GLF Soil Bldg. Service, Div. of Coop. GLF Exchange, Inc., New York, N. Y.; **Fred Shanaman,** Pres., Pennsylvania Salt Mfg. Co. of Washington, Tacoma, Wash.; **Russell B. Stoddard,** Coor. of Insecticide Operations, U. S. Industrial Chemicals Co., Div. of National Distillers Prod. Corp., New York, N. Y.; **Byron P. Webster,** Vice-Pres., Chipman Chemical Co., Inc., Bound Brook, N. J.; **J. M. Taylor,** Pres., Taylor Chemical Co., Aberdeen, N. C.

The immediate past president, Ernest Hart, vice-president of the Food Machinery and Chemical Corporation, San Jose, Calif., and Lea S. Hitchner, are ex-officio members of the board of directors. (*Photo, page 50.*)

Top: E. D. Witman, Columbia-Southern Chemical, W. F. Hall, Chipman Chemical, G. K. Schumaker, Velsicol and E. K. Plant, Columbia Southern Chemical; Center: J. A. Singmaster, Monsanto Chemical, Ernest Hart, Niagara Chemical Division, John S. Coey, Hooker Electrochemical, and W. M. Russell, Monsanto Chemical; Bottom: L. G. Gemmell, Geigy, E. R. Marshall, GLF Soil Building Service and J. L. Horsfall, American Cyanamid.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Fertilizer use in West differs from technique elsewhere, paper shows.

Phosphate Fertilizers For Western Agriculture

By K. D. Jacob

Bureau of Plant Industry, Soils, and Agricultural Engineering
Agricultural Research Administration
United States Department of Agriculture
Beltsville, Maryland

THE importance of fertilizer to American agriculture and to the Nation is indicated by the proportion of the total crop production that results from the use of fertilizer. The part attributable to fertilizer varies with the region, the locality and the crop. For the United States as a whole, it is estimated that this proportion was nearly 14.5 per cent in 1938, 22 per cent in 1948 and possibly as high as 25 per cent in 1951. Fertilizer also provides the plant-nutrient elements necessary for the maintenance and improvement of the fertility of the soil, and its use is essential in successful programs of soil-erosion control and water conservation.

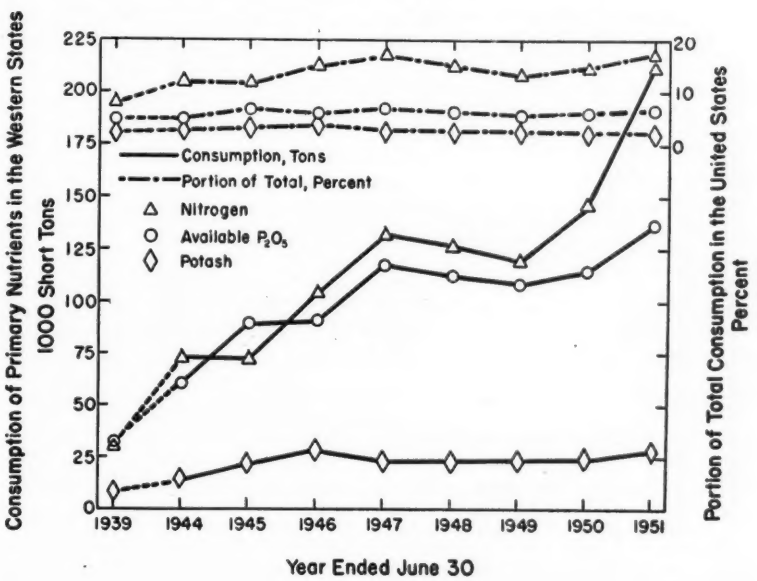
The eleven westernmost States have perhaps more abundant supplies of fertilizer raw materials and processing requisites than any other area of like size in the world. These materials include large resources of phosphate rock, potash salts and sulfur-bearing minerals; deposits of boron, copper, manganese, molybdenum and zinc compounds; and huge reserves of calcium and magnesium. Coal, petroleum, natural gas and water power are available in most of the area for use in the fixation of atmospheric nitrogen and in the processing of other fertilizer raw materials.

This paper summarizes the recent progress in the use of fertilizers in the Western States and indicates the need for fertilizers in that area, with special reference to phosphates. The solubility of phosphate fertilizers in water and neutral ammonium citrate solution is discussed in relation to their effectiveness as sources of phosphorus for crops on alkaline soils. Present and prospective facilities for manufacturing phosphate fertilizers in the West are reviewed.

In common with the rest of the country, consumption of commercial plant nutrients in the Western States has increased greatly since 1939 (Figure 1, Table I). New levels for the use of nitrogen (N) and available phosphoric oxide (P_2O_5) in the West were successively reached in most of the years, and previous records for these nutrients, as well as for potash (K_2O), were broken in 1951. Thus the respective consumptions of nitrogen (212,323 tons), P_2O_5 (136,915 tons) and K_2O (27,655 tons) in 1951 were approximately seven, four and three times those in 1939. For the United States and Territories the total consumptions of each of these nutrients were roughly three tmes those in 1939.

The Western States used 7.8 per

Figure 1. Tonnage of Primary Plant Nutrients Consumed in the Western States and Portion of Total Consumption in the United States and Territories.



Presented at the Third Annual Pacific Northwest Fertilizer Conference, Pocatello, Idaho, July 9 to 11, 1952.

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	N	P_2O_5	K_2O
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Diammonium Phosphate (Crystals)	21.0%	53.85%	–0–
Monoammonium Phosphate (Crystals)	12.2%	61.61%	–0–
Phosphoric Acid (75.0%) (Liquid)	–0–	54.5%	–0–

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cent of the nitrogen consumed as commercial fertilizer in the United States and Territories in 1939, as compared with 17.1 per cent in 1951 (Figure 1). The proportionate consumptions of P_2O_5 and K_2O were 4.5 and 2.1 per cent in 1939 and 6.5 and 2.0 per cent in 1951. The use of nitrogen has generally tended to increase at a faster rate in the West than in the Nation as a whole. Since 1945, however, the rate of increase in P_2O_5 consumption in the West has been about the same as in the rest of the country, whereas the trend in the proportionate consumption of K_2O has been downward.

In 1951 the N–P_2O_5–K_2O ratio in the total commercial fertilizer used in the West was 1.00–0.64–0.13, as compared with a ratio of 1.00–2.03–1.37 in the total fertilizer used in the rest of the continental United States (*14*)[1]. This difference reflects in particular the relatively large use of nitrogen on truck and citrus crops in California and Arizona and the generally high level of exchangeable potassium in western soils. The ratio was 1.00–1.16–0.06 in the Mountain States and 1.00–0.52–0.15 in the Pacific States. For the six Western States that each used a total of more than 10,000 tons of primary nutrients (N, available P_2O_5, K_2O) in 1951 the ratios were as follows:

State	*Nutrient ratio*
Idaho	1.00–2.74–0.08
Colorado	1.00–1.63–0.17
Arizona	1.00–0.50–0.03
Washington	1.00–0.79–0.33
Oregon	1.00–0.78–0.18
California	1.00–0.47–0.13

The total pattern of nutrient consumption as mixed fertilizers and as straight materials in the West is quite different from that in the rest of the States. According to the data reported by Scholl and Wallace (*14*) for the year ended June 30, 1951, only 24.4 per cent of the total consumption of primary nutrients as commercial fertilizer in the West was in the form of mixtures, as compared to 75.7 per cent in the other States. For the individual nutrients consumed as mixtures the respective proportions were as follows: nitrogen, 15.4 and 53.4 per cent; available P_2O_5, 29.4 and 76.0 per cent; and K_2O, 67.7 and 91.6 per cent. Because of the relatively large use of straight materials, the problems of reactions and compatibilities in mixed fertilizers tend to be of less significance in the West than in other parts of the country.

As shown in Table II, California used 66,270 tons of available P_2O_5 as commercial fertilizer in 1951. This was approximately 74 per cent of the total consumption in the Pacific States and 48 per cent of that in the West. Only three other States (Colorado, Arizona and Oregon) used more than 10,000 tons of P_2O_5 each. These three States and California used nearly 75 per cent of the P_2O_5 consumed in the West in 1951. The distribution of the total consumption between the Mountain and Pacific States was 35 per cent and 65 per cent, respectively.

The available P_2O_5 in mixed fertilizers used in the West is supplied chiefly by normal and triple superphosphates, ammonium phosphate (11–48–0) and ammonium phosphate-sulfate (16–20–0), which furnish this nutrient principally in water-soluble forms. However, the reactions of the phosphates with ammonia and other basic materials may result in a substantial reduction of the water-soluble P_2O_5 in mixed fertilizers.

As reported by Scholl and Wallace (*14*) the principal phosphates applied as separate materials in the West in the year ended June 30, 1951, were as shown in table A, page 24.

With the exception of bonemeal, mineral phosphate and usually ammoniated superphosphate, 75 per cent or more of the P_2O_5 in these materials is readily soluble in water.

Table 1. Consumption of Primary Nutrients as Commercial Fertilizer in the Years Ended June 30, 1939 and 1951 and Estimate of Need in 1955

Year	Short tons			
	Nitrogen	Available P_2O_5	K_2O	Total
Western States				
1939	30,006	32,133	8,407	70,546
1951	212,323	136,915	27,655	376,893
1955[a]	290,897	208,707	24,896	524,500
United States[b]				
1939	351,360	695,808	375,460	1,422,628
1951	1,171,418	2,086,007	1,337,322	4,594,747
1955[a]	1,977,291	3,220,831[c]	1,916,142	7,114,264

[a] Estimated by State Productive Capacity Committees (*15*).
[b] Excluding Territories.
[c] Includes 211,000 tons of total P_2O_5 in the form of ground, raw phosphate rock in Illinois.

Need for Plant Nutrients

A Nation-wide study was recently undertaken by the Land Grant Colleges and the U. S. Department of Agriculture to appraise the productive capacity of American agriculture in the mobilization period and the critical materials needed to achieve the production believed to be attainable by 1955. Estimates of the quantities of primary plant nutrients in commercial fertilizers needed for the level and pattern of agricultural production attainable in 1955 were reported by the State Productive Capacity Committees (*15*). The respective total needs for nitrogen, P_2O_5 and K_2O as estimated for the Western States and

[1] Italic numerals in parentheses refer to "Literature Cited" at end of paper.

A. Material	Short tons of material
Superphosphate, normal	135,081
Ammonium phosphate-sulfate (16–20–0)	86,488
Superphosphate, triple	78,237
Ammonium phosphate (11–48–0)	9,591
Phosphoric acid, liquid	9,575
Superphosphate, ammoniated	2,918
Mineral phosphate, raw	2,062
Bonemeal, raw	1,980

Table 2. Consumption of Available P_2O_5 as Commercial Fertilizer in the Year Ended June 30, 1951 and Estimate of Need in 1955

State and region	Short tons 1951	Short tons 1955[a]	Increase, per cent
Montana	5,328	9,930	86
Idaho	9,186	26,276	186
Wyoming	2,040	3,839	88
Colorado	11,050	10,271	–7
New Mexico	5,188	8,663	67
Arizona	11,174	13,115	17
Utah	3,472	4,339	25
Nevada	250	2,476	890
Mountain	47,688	78,909	65
Washington	9,417	12,733	35
Oregon	13,540	15,556	15
California	66,270	101,509	53
Pacific	89,227	129,798	45
Western States	136,915	208,707	52
United States[b]	2,086,007	3,220,831[c]	54

[a] Estimated by State Productive Capacity Committees (*15*).
[b] Excluding Territories.
[c] Includes 211,000 tons of total P_2O_5 in the form of ground, raw phosphate rock in Illinois.

the continental United States, respectively, are shown in Table I. The distribution of the need for P_2O_5 among the individual States of the West is shown in Table II.

Compared with the consumption in the West in the year ended June 30, 1951, the indicated needs for 1955 represent increases of 37 per cent in nitrogen and 52 per cent in P_2O_5 but a decrease of 10 per cent in K_2O. Increases of 69 per cent in nitrogen, 54 per cent in P_2O_5 and 43 per cent in K_2O are indicated for the continental United States as a whole. It will be noted that the indicated rate of increase for P_2O_5 in the West is close to that for the entire country, but those for nitrogen and especially K_2O are much lower.

It should be mentioned that the estimates made for the United States by the State Productive Capacity Committees are appreciably lower than the 1955 goals for commercial plant nutrients in the production expansion program sponsored by the U. S. Department of Agriculture (*13*). The 1955 goals include the Territories and are not broken down by political subdivisions; they are as follows:

Nutrient	Goal for 1955, short tons
Nitrogen	2,185,000
Available P_2O_5	3,485,000
K_2O	2,185,000

The quantities of nutrients indicated in the 1955 goals are expected to be sufficient to permit high-level production of food and fiber crops, the adoption of fertilization practices conducive to sustained high-level production and the building of soil fertility reserves.

The need for P_2O_5 in 1955—as estimated by the State Productive Capacity Committees—in relation to the consumption in 1951, shows wide variation among the Western States (Table II). For example, the estimated need in Colorado is 7 per cent less than the quantity used in 1951. Increases are indicated for the other States. They range from 15 per cent in Oregon and 17 per cent in Arizona to 186 per cent in Idaho and 890 per cent in Nevada. These differences reflect not only the State to State variations in such pertinent factors as cropping and soil-management practices, soil fertility levels, water supply and climatic conditions but also variations in the adequacy of the experimental data upon which to base sound estimates of the present and future needs for plant nutrients.

Solubility Relationships in Phosphate Fertilizers

As previously pointed out (*6*), phosphate fertilizers may be classified conveniently into three groups on the basis of their solubilities in water and neutral ammonium citrate solution, namely, (1) those in which the P_2O_5 is mostly if not entirely soluble in water, (2) those not readily soluble in water but largely or completely soluble in ammonium citrate and (3) those insoluble in water and only slightly soluble in ammonium citrate. For fertilizer control purposes in the United States, however, no distinction is usually made between water-soluble P_2O_5 and citrate-soluble P_2O_5 and the phosphates are commonly evaluated in terms of their content of so-called available P_2O_5, i.e., the total P_2O_5 minus the P_2O_5 insoluble in neutral ammonium citrate.

The available P_2O_5 appears to be a generally satisfactory criterion of the relative value of a material as a source of phosphorus for crops on soils that are acid or neutral in reaction. On the other hand, there is an increasing volume of evidence that water-soluble phosphates are usually more efficient sources of phosphorus for crops on alkaline soils, such as predominate in the West, than are phosphates in which all or a major portion of the P_2O_5 is insoluble in water but is soluble in citrate solution. In view of this situation, the fertilizer control officials of the Western States might well consider requiring that phosphate materials and mixtures be guaranteed with respect to both water-soluble and available P_2O_5.

The solubility relationships of the P_2O_5 in typical phosphate fertilizer materials are shown in Table III. The water-soluble materials comprise phosphoric acid (H_3PO_4), mono- and diammonium phosphates, ammonium phosphate-sulfate, monopotassium phosphate, normal and triple superphosphates and wet-base goods (made by treating a mixture of phosphate rock and nitrogenous organic material with sulfuric acid). In these materials the solubility of the P_2O_5 in water averages 75 per cent or more.

The citrate-soluble phosphate fertilizers include dicalcium phosphate (often called precipitated phosphate and precipitated bone); basic slag; the calcium and potassium metaphosphates; defluorinated phosphate rock (fused tricalcium phosphate and alpha phosphate); phosphate rock—magnesium silicate glass (calcium magnesium phosphate, Thermo-Phos, and MP Phosphate); Rhenania-type phosphate; and precipitated iron and aluminum phosphates. These products contain very little water-soluble P_2O_5, but some 80 per cent or more of the total P_2O_5 is soluble in neutral ammonium citrate solution, provided the sample is ground sufficiently fine. The degree of fineness necessary for attainment of maximum or near maximum citrate solubility of the P_2O_5 under the conditions of the official method of analysis (*2*) varies with the kind of material; it ranges to 100 mesh or finer (*5*, *7*, *9*).

Table 3. Solubility of P_2O_5 in Typical Phosphate Materials

Material	Total P_2O_5 per cent	Percentage of total P_2O_5 as: Water-soluble P_2O_5	Citrate-soluble P_2O_5	Available P_2O_5
Phosphoric acid, wet-process material for direct use as fertilizer	52.6	100	0	100
Ammonium phosphate (11–48–0)	49.3	89	9	98
Ammonium phosphate-sulfate (16–20–0)	21.1	86	12	98
Superphosphate, normal	20.5	78	18	96
Superphosphate, triple	46.9	84	13	97
Calcium metaphosphate	63.6	1	98	99
Dicalcium phosphate, fertilizer grade	40.4	5	91	96
Fused tricalcium phosphate	28.1	0	79	79
Basic slag, domestic	11.9	0	86	86
Rhenania-type phosphate	26.1	0	92	92
Phosphate rock—magnesium silicate glass	22.1	0	88	88
Potash-phosphate ash	30.0	34	43	77
Bonemeal	24.5	0	57	57
Phosphate rock	33.0	0	8	8

Although bonemeal and precipitated tricalcium phosphate can be included with the citrate-soluble phosphates, different samples of these materials may show wide variations in their solubilities. In general, approximately 50 per cent of the P_2O_5 in bonemeal is soluble in neutral ammonium citrate solution. The solubility of the P_2O_5 of tricalcium phosphate depends markedly on the conditions under which the material is precipitated and dried; usually the solubility is about 50 per cent, but it may be as high as 95 per cent (*8*, *9*).

Raw mineral phosphate is the principal member of the third group of materials, namely, those insoluble in water and only slightly soluble in ammonium citrate solution. Besides phosphate rock and apatite, this member includes the Florida soft phosphate and wastepond (colloidal) phosphate.

Although normal and triple superphosphates are the source of most of the P_2O_5 in mixed fertilizers manufactured in the United States, the average solubility in water of the P_2O_5 in the mixtures is usually decidedly lower than that of the P_2O_5 in the superphosphates. This results chiefly from reactions of the water-soluble phosphates with the additions of ammonia and other basic materials, principally dolomitic limestone.

Clark and Hoffman (*3*) studied the solubility relationships of the P_2O_5 in representative samples of mixed fertilizers marketed in the various regions of the United States during the 1949–1950 fertilizer season. For the United States as a whole, the average results indicate a nearly equal distribution of the available P_2O_5 between water-soluble and citrate-soluble forms (Table IV). In terms of the total P_2O_5, the solubility of the P_2O_5 in water ranged from 35.2 and 39.8 per cent in the East South Central and South Atlantic regions to 64.6 and 70.7 in the Pacific and Mountain regions, respectively. The low water-solubility of the P_2O_5 in the first two regions reflects the general practices therein of (1) high-level ammoniation and (2) extensive use of dolomitic limestone in the preparation of nonacid-forming mixtures. The principal factors contributing to the relatively high water-solubility of the P_2O_5 in the Mountain and

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Pacific regions were (1) the limited use of ammoniation at the time of the survey and (2) the preference for acid-forming mixtures because of the predominantly alkaline nature of the soils.

Chemistry and Properties of Ammoniated Superphosphate

Fixation of free ammonia by direct reaction with the constituents of superphosphates was first adopted on a commercial scale in the United States in 1928. Subsequently, the practice has increased to such an extent that more than 50 per cent of the 545,000 short tons of nitrogen consumed as mixed fertilizers in the continental United States in the year ended June 30, 1951, was added to the mixtures in the form of anhydrous ammonia, aqua ammonia and mostly aqueous solutions of free ammonia and urea or, chiefly, ammonium nitrate. This has enabled the manufacturers of mixed fertilizers to utilize effectively the cheapest forms of nitrogen (*12*) and at the same time usually to improve substantially the physical condition of the mixtures. Ammoniation of straight superphosphates is also practiced to some extent.

The reactions that occur in the ammoniation of superphosphate, either alone or in mixed fertilizers, depend on several factors but chiefly the type of superphosphate and the quantity of free ammonia added (*10*, *16*). They involve conversion of water-soluble into citrate-soluble P_2O_5 and usually the formation of some citrate-insoluble P_2O_5. Hydrated monocalcium phosphate ($Ca(H_2PO_4)_2.H_2O$) is the source of most of the water-soluble P_2O_5 in both normal and triple superphosphate. The calcium sulfate that constitutes about 50 per cent of the weight of normal superphosphate plays an important part in the ammoniation reactions of this type of superphosphate. Triple superphosphate, on the other hand, commonly contains only minor quantities of calcium sulfate.

The principal reactions that take place when increasing quantities of free ammonia, up to the maximum possible quantity of about 8.5 per cent, are fixed by normal superphosphate may be represented by Equations A:

Table 4. Solubility of P_2O_5 in Mixed Fertilizers[a]

Region	Number of samples	Percentage of total P_2O_5 as: Water-soluble P_2O_5	Citrate-soluble P_2O_5	Available P_2O_5
New England	34	44.6	51.3	95.9
Middle Atlantic	50	49.7	44.9	94.6
South Atlantic	117	39.8	51.7	91.5
East South Central	48	35.2	56.4	91.6
West South Central	23	51.3	40.8	92.1
East North Central	81	50.7	42.0	92.7
West North Central	30	52.1	42.0	94.1
Mountain	20	70.7	24.9	95.6
Pacific	17	64.6	31.2	95.8
United States	420	46.9	46.1	93.0

[a] Data from Clark and Hoffman ( ).

Equations A

$< 1\%\ NH_3$: $H_3PO_4 + NH_3 = NH_4H_2PO_4$ (1)

1-2.5% NH_3 : $Ca(H_2PO_4)_2 \cdot H_2O + NH_3 = CaHPO_4 + NH_4H_2PO_4 + H_2O$ (2)

2.5-8.5% NH_3: $NH_4H_2PO_4 + CaSO_4 + NH_3 = CaHPO_4 + (NH_4)_2SO_4$ (3)

$2CaHPO_4 + CaSO_4 + 2NH_3 = Ca_3(PO_4)_2 + (NH_4)_2SO_4$ (4)

According to these equations, addition of up to about 2.5 per cent of free ammonia to normal superphosphate involves reactions that result in the formation of water-soluble monoammonium phosphate and citrate-soluble dicalcium phosphate (equations 1 and 2). With further addition of ammonia, reactions involving the calcium sulfate take place with formation of additional dicalcium phosphate and conversion of the latter into tricalcium phosphate (equations 3 and 4). It appears that more-basic phosphates, notably fluorapatite ($Ca_{10}F_2(PO_4)_6$), may also be formed in the ammoniation of normal superphosphate (*4*), and that formation of such phosphates is largely responsible for any decrease that may occur in the availability of the P_2O_5.

Figure 2 shows the distribution of the P_2O_5 among the water-soluble, citrate-soluble and available fractions in relation to the quantity of free ammonia added to

Figure 2. Distribution of P_2O_5 Among the Water-Soluble, Citrate-Soluble and Available Fractions of a Normal Superphosphate Ammoniated with Anhydrous Ammonia.

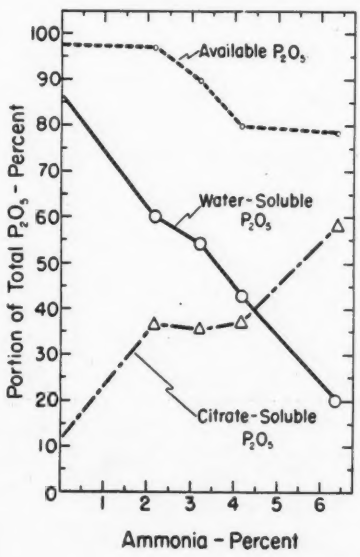
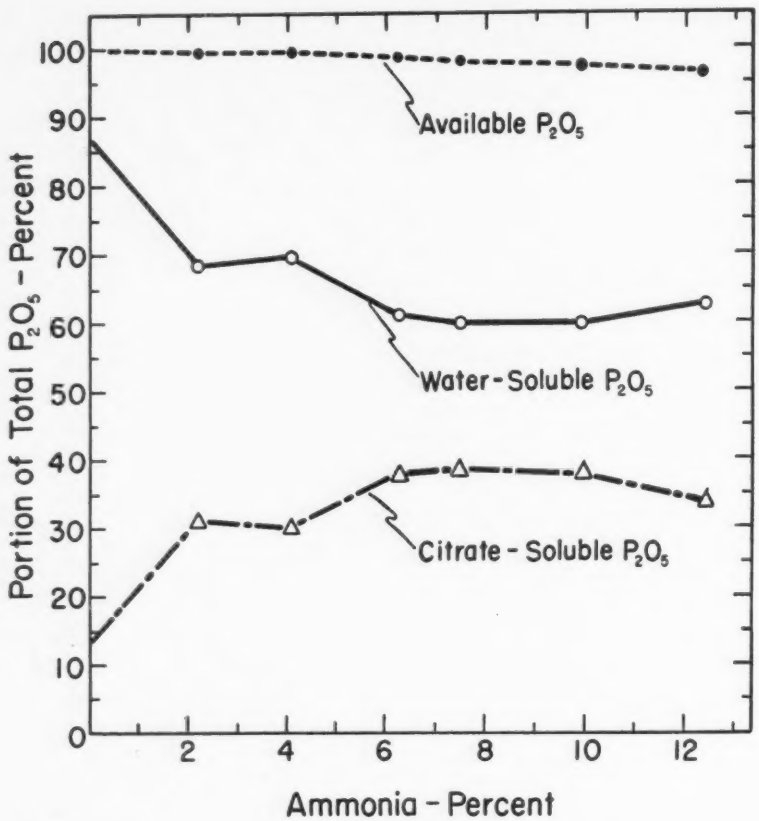


Figure 3. Distribution of P_2O_5 Among the Water-Soluble Citrate-Soluble and Available Fractions of a Triple Superphosphate Ammoniated with Anhydrous Ammonia. (White, Hardesty and Ross (16).)



Equations B

$$1\%\ NH_3 : H_3PO_4 + NH_3 = NH_4H_2PO_4 \quad (5)$$

$$1\text{-}6\%\ NH_3 : Ca(H_2PO_4)_2 \cdot H_2O + NH_3 = CaHPO_4 + NH_4H_2PO_4 + H_2O \quad (6)$$

$$<6\text{-}12\%\ NH_3 : NH_4H_2PO_4 + NH_3 = (NH_4)_2HPO_4 \quad (7)$$

$$12\text{-}14\%\ NH_3 : 3CaHPO_4 + 2NH_3 = Ca_3(PO_4)_2 + (NH_4)H_2PO_4 \quad (8)$$

B.

Nitrogen	Percentage of: P_2O_5 Total	P_2O_5 Available	Percentage of available P_2O_5 as: Water-soluble P_2O_5	Citrate-soluble P_2O_5
0	19.90	19.45	94.6	5.4
2.06	20.22	18.90	67.2	32.8
4.53	17.98	16.73	29.9	70.1

a normal superphosphate[2]. The superphosphate, made commercially from Florida pebble phosphate rock, was ammoniated in 75-pound quantities with anhydrous ammonia. The maximum temperature during ammoniation ranged from 82° to 107° C., and the products were cooled to room temperature immediately after ammoniation.

With increasing quantities of free ammonia to the maximum used in these experiments (6.3 per cent of the ammoniated superphosphate), the solubility of the P_2O_5 in water decreased progressively from 86 per cent to 20 per cent while the proportion of citrate-soluble P_2O_5 increased from 11 per cent to 58 per cent. At the same time the availability of the P_2O_5 decreased from 97 per cent to 78 per cent.

Owing to the low content of calcium sulfate in triple superphosphate, the reactions in the ammoniation of this material differ, in part, from those in the ammoniation of normal superphosphate. The principal reactions of triple superphosphate with increasing quantities of free ammonia are indicated by Equations B.

The first two reactions for triple superphosphate (equations 5 and 6) are the same as the corresponding reactions for normal superphosphate (equations 1 and 2), and they take place at approximately the same levels of ammoniation in relation to the respective P_2O_5 contents of the superphosphates. In the range of 6 to 12 per cent of ammonia the reaction (equation 7) involves merely the conversion to diammonium phosphate of the monoammonium phosphate formed in the preceding reactions. Formation of tricalcium phosphate according to equation 8 occurs only when the triple superphosphate is ammoniated at elevated temperatures in closed containers. The small quantity of calcium sulfate commonly present in triple superphosphate may result, however, in the formation of some tricalcium phosphate and ammonium sulfate in accordance with equation 4. With triple superphosphate, the

[2] Data by J. O. Hardesty and R. Kumagai, Bureau of Plant Industry, Soils, and Agricultural Engineering.

usual practice of ammoniating in open vessels does not favor the formation of more-basic phosphates.

As reported by White, Hardesty and Ross (*16*), Figure 3 shows the distribution of P_2O_5 among the water-soluble, citrate-soluble and available fractions in relation to the quantity of free ammonia (up to 12.4 per cent) added to a triple superphosphate in a rotating drum. Progressively increasing the ammonia to 6.3 per cent caused the solubility of the P_2O_5 in water to decrease progressively from 87 per cent to 61 per cent. At the same time the proportion of citrate-soluble P_2O_5 increased from 13 per cent to 38 per cent, but the available P_2O_5 changed only slightly. Further additions of ammonia had little effect on the solubility and availability of the P_2O_5.

As previously pointed out, there is increasing evidence that water-soluble phosphates are usually more efficient than citrate-soluble phosphates as sources of phosphorus for crops on alkaline soils. This is strikingly shown in the study recently made by Martin, Vlamis and Quick (*11*)[3] of the response of lettuce under greenhouse conditions to different levels of water-soluble P_2O_5 in ammoniated normal superphosphate, in relation to the *p*H values of several California soils. The composition of the superphosphates was as shown in Table B, page 28.

Wide differences in the degree of ammoniation of the superphosphate and, correspondingly, in the distribution of the available P_2O_5 between the water-soluble and citrate-soluble fractions had little or no effect on the yield of lettuce on a Rocklin sandy loam of *p*H 5.6 (Figure 4). Also, light ammoniation of the superphosphate, with reduction of the water-soluble fraction of the available P_2O_5 from 95 per cent to 67 per cent, did not decrease the average effectiveness of the material as a source of phosphorus for lettuce on calcareous Linne sandy clay loam and Meloland fine sandy loam soils of *p*H 7.9 and 8.0, respectively (Figure 5). On the other hand, further reduction of the water-soluble fraction to 30 per cent of the available P_2O_5, as by high ammoniation of the superphosphate, affected very adversely the yield of lettuce on the calcareous soils at all rates of P_2O_5 application.

[3] Through the courtesy of the authors, the writer was privileged to read the manuscript in which the results of this study were reported. Reference thereto is made with the authors' permission.

Figure 4. Effect of Degree of Ammoniation of Normal Superphosphate and Rate of Application of Available P_2O_5 on Yield of Lettuce on Rocklin Sandy Loam, pH 5.6. (Martin, Vlamis and Quick (11).)

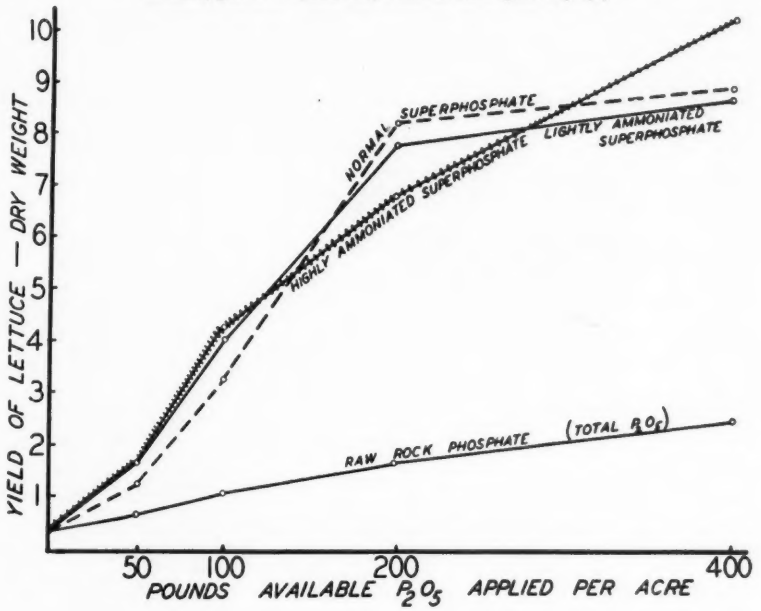
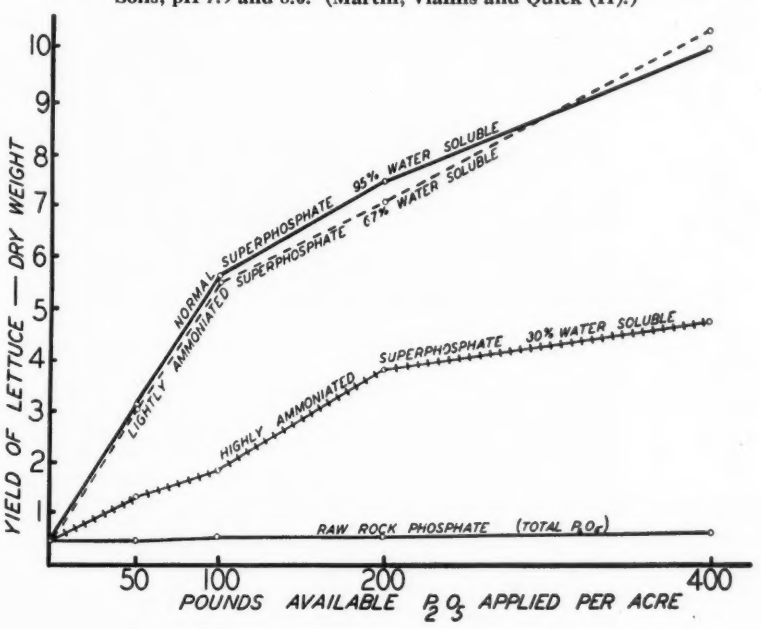

YIELD OF LETTUCE — DRY WEIGHT
POUNDS AVAILABLE P_2O_5 APPLIED PER ACRE
NORMAL SUPERPHOSPHATE
HIGHLY AMMONIATED SUPERPHOSPHATE
LIGHTLY AMMONIATED SUPERPHOSPHATE
RAW ROCK PHOSPHATE (TOTAL P_2O_5)

Figure 5. Effect of Degree of Ammoniation of Normal Superphosphate and Rate of Application of Available P_2O_5 on Average Yield of Lettuce on Two Calcareous Soils, pH 7.9 and 8.0. (Martin, Vlamis and Quick (11).)


YIELD OF LETTUCE — DRY WEIGHT
POUNDS AVAILABLE P_2O_5 APPLIED PER ACRE
NORMAL SUPERPHOSPHATE 95% WATER SOLUBLE
LIGHTLY AMMONIATED SUPERPHOSPHATE 67% WATER SOLUBLE
HIGHLY AMMONIATED SUPERPHOSPHATE 30% WATER SOLUBLE
RAW ROCK PHOSPHATE (TOTAL P_2O_5)

Facilities for Manufacture of Phosphate Fertilizers

Facilities in western United States and Canada for producing chemically processed phosphate fertilizers comprise plants for manufacture of normal and triple superphosphates, ammonium phosphate (11–48–0), ammonium phosphate-sulfate (16–20–0), wet-process phosphoric acid for direct use as fertilizer, and wet-mixed N-P-K fertilizer. Small tonnages of so-called

(*Continued on page 70*)

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Pesticide Outlook for '53

By Harold H. Shepard

Staff Specialist, Office of Materials & Facilities, PMA, U.S.D.A.

PESTICIDES must be available in quantities adequate to provide for domestic needs. Otherwise food and fiber crops cannot be grown, processed and stored without expensive losses. Some uses of pesticides are fairly uniform and predictable from year to year. The scheduled applications to protect fruit orchards are in this class. Here the dealer and his supplier have some assurance that the grower will use quantities the next year similar to those he used during the preceding season.

Predicting Need

On the other hand, truck crops and cotton, for example, are often subject to severe losses from pest activity, but much of the pest control on these crops is done only if and when damage begins to be apparent. Infestations on cotton being dependent upon such factors as weather, are as unpredictable in their variations as the weather. It is too late to manufacture the insecticide after the insect makes its appearance. We must have the extinguisher on the wall ready to use when a fire breaks out. We must have enough pesticides on hand to suppress foreseeable infestations.

Serious insect infestations in 1950 resulted in a heavy demand so that inventories generally were at a minimum at the end of the growing season. In 1951, not only was production increased greatly to overtake domestic demand in most cases, but some of the more destructive pests failed to develop in serious numbers. As a result, producers' inventories of some materials in 1951 and 1952 became too large to be stored without hardship.

Continual Problem

It can be expected that situations such as this—from shortage to over-supply—will recur. The pesticide industry, faced with such conditions has the alternative of carrying its surpluses over to the following season or exporting them to other consuming countries.

For other news about the National Agricultural Chemicals Association, see pages 14 and 38.

Estimates of domestic pesticide requirements made by the Office of Materials and Facilities, Production and Marketing Administration, are based chiefly upon two sets of data: (1) reports of production and of inventory position received directly or indirectly from the industry and (2) state estimates of the expected percentage shift in usage during the following crop year.

Export data are not so generally available. Domestic disappearances at the level of the basic producer for a particular period are calculated from production by taking into account the relative inventory positions at the beginning and end of the period, then subtracting the amount exported if that information is available. The annual period in use by this office is the crop year from Oct. 1 to the following Sept. 30.

Frequently domestic disappearance figures such as these are spoken of as consumption, whereas a considerable proportion of the disappearance may have gone merely to fatten the distributional pipeline. Some thought is being given to appropriate means for estimating pipeline holdings, at least on a relative or percentage basis.

The table shows our estimate of disappearance for the crop year 1949–50, of both requirements and the subsequently calculated disappearances for 1950–51 and the requirements for 1951–52. Requirements estimates presented in the past have indicated the quantities needed if reasonably heavy infestations were encountered during the year. It would appear of additional value to present these estimates so as to show both the quantity believed necessary to control maximum pest infestations likely to be experienced and the quantity for probable minimum over-all conditions.

Estimates for '53

These two sets of estimates are given here for the 1952–53 crop year. Pesticides usually have a number of effective uses and these

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uses coincide to greater or less extent for the different chemicals. Not all uses will be at a maximum during the same season. If it were not for these facts maximum requirements estimates would have to be higher for some of these pesticides.

It should be remembered that the present estimates for next year are made without benefit of complete disappearance data for the crop year 1951–52 or of state survey estimates of the expected shift in usage for next year. These figures are, therefore, preliminary and tentative; on the other hand they are based upon extensive data accumulated over the past two seasons.

DDT.—DDT may be considered the leading synthetic organic pesticide. It is applied for many specific purposes, and its consumption will be more uniform from year to year than that of materials with fewer established major uses. Methyoxychlor and DDD both compete to some extent with DDT. The relative volume of usage of these materials, however, is small as compared to that of DDT.

DDT Production

In the 1949–50 crop year, production of DDT ran behind domestic demand and nearly 90 per cent of production or 59,000,000 pounds appears to have been used in this country. In the year 1950–51, domestic disappearance was between 75 and 80,000,000 pounds, but this was less than 80 per cent of the production during the period. It is believed that consumption of DDT in the United States in the next crop year will be between 70 and 85 million pounds.

Benzene Hexachloride.—Estimation of future requirements of benzene hexachloride is complicated by the fact that the use of lindane and some other high-gamma grades of this compound probably will come into increased usage for new purposes while other chemicals might partially displace lower grades of benzene hexachloride for some uses, as for instance against boll weevil on cotton.

The minimum requirement of gamma benzene hexachloride for next season is estimated to be 9,500,000 pounds, including 2,000,000 pounds of lindane. In terms of 12 per cent technical BHC this requirement would amount to about 79,000,000 pounds. The estimated maximum requirement for this material is 11,400,000 pounds on a gamma basis, equivalent to 95,000,000 pounds of 12 per cent material. These figures may be compared to the domestic disappearance in 1950–51 of 80,000,000 pounds.

Dr. H. H. Shepard, left, talks with R. F. Byrnes, Rohm & Haas Co. and K. K. Krausche, Penn Salt Co. in lobby of Essex and Sussex Hotel, Spring Lake, N. J., at after session of annual NAC convention.

Other Chemicals

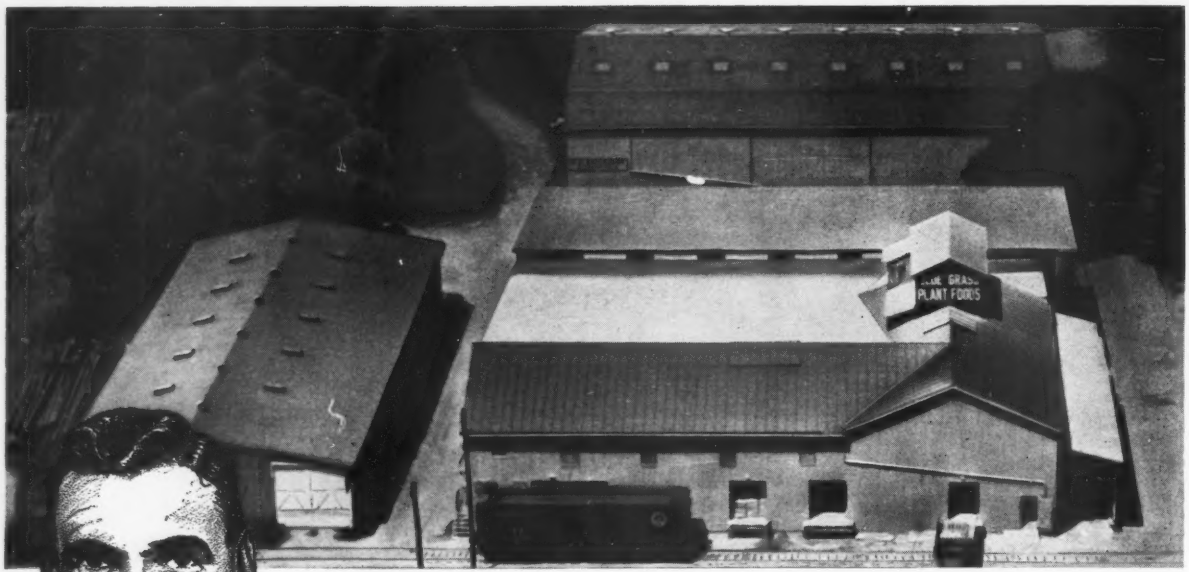
Aldrin, Chlordane, Dieldrin, Heptachlor, and **Toxaphene.**—Each of the materials—aldrin, chlordane, dieldrin, heptachlor and toxaphene—is manufactured by a single producer but all are more or less in competition. Not having as broad a use base as DDT the minimum and maximum requirements of this group should exhibit a wider spread than the requirements of that insecticide. The individual chemicals included in this group differ markedly in their potency per unit of weight. Comparisons of these compounds as a group, therefore, perhaps do not mean very much. It is believed however that the 1952–53 requirements will be at least 65,000,000 pounds and possibly as high as 90,000,000 pounds.

Parathion.—Domestic consumption of parathion has increased steadily since its introduction, apparently amounting to 2,551,000 pounds in 1949–50 and 4,670,000 pounds in 1950–51. Minimum requirements in 1952–53 will probably be 5,500,000 pounds and usage may reach 6,500,000 pounds.

Lead Arsenate.—Disappearance of lead arsenate was about 30,000,000 pounds a year in 1949–50 and 1950–51. This year (1951–52) the disappearance will be appreciably less, presumably because of inventories at the beginning of the year. It seems reasonable, therefore, to estimate requirements of lead arsenate for 1952–53 at a minimum of 20,000,000 and a maximum of 30,000,000 pounds.

Calcium Arsenate.—As in the case of lead arsenate, disappearance of calcium arsenate was about the same in 1950–51 as in 1949–50, amounting to around 39,000,000 pounds each year. Disappearance will be decidedly less in 1951–52 and estimates for 1952–53 are 15,000,000 pounds as a minimum and 40,000,000 pounds as a maximum. The large difference between these figures is caused by the fact that this insecticide is not only dependent upon boll weevil infestations on cotton, but it competes with several cotton insecticides which are effective against a much greater range of pests.

Pyrethrum Flowers.—Average



This air view shows one of Kentucky's famous fertilizer plants, Blue Grass Plant Foods, Incorporated of Cynthiana, Kentucky. This firm has specialized in fertilizers for one of Kentucky's most famous crops—burley tobacco. Established in 1948, the plant was expanded in 1950 and today produces more than 20,000 tons annually.

Gene Van Deren is Vice-President of Blue Grass Plant Foods, Incorporated, a major mixer in Central and Northern Kentucky.

Blue Grass Plant Foods, Inc.

...Another Spensol User

America's leading fertilizer mixers depend on Spensol (Spencer Nitrogen Solutions) to give them well-conditioned, low-cost fertilizer. From conveniently located plants like this, Spencer ships direct to your plant siding.

These technical service experts are ready to help you, whether you're a Spencer customer or not. They specialize in finding the right answers to your production problems. There's no charge or obligation for this Spencer service.

SPENCER CHEMICAL COMPANY, Dwight Bldg., Kansas City 6, Mo.
Southeastern District Sales Office: 412 Candler Bldg., Atlanta, Ga.
Works: Pittsburg, Kansas; Henderson, Ky.; Charlestown, Ind.; Chicago, Ill.

America's Growing Name in Chemicals

annual imports of pyrethrum flowers for the three-year period 1949 to 1951 were about 8,000,000 pounds. This figure has been taken as the estimated minimum requirement of pyrethrum flowers for 1952–53. The maximum requirement is estimated to be 10,000,000 pounds, corresponding to the highest annual imports in that period.

Rotenone-bearing Roots.—Requirements of rotenone-bearing roots for 1952–53, estimated in a similar manner, are 7,000,000 pounds as a minimum and 10,000,000 pounds as a maximum.

Information Lacking

Ground Sulfur.—Accurate information regarding the production of ground sulfur for pesticidal purposes is not available prior to 1949–50, and only rough estimates can be obtained for the rather large exports of pesticidal sulfur. Estimates of domestic consumption, therefore, are not as precise as for many of the other pesticidal materials. Because the quantity of sulfur used to control pests has decreased during the past two years from probably the highest consumption in 1949–50, it appears likely that domestic consumption in 1952–53 will be somewhere between 356,000,000 and 423,000,000 pounds.

For comparison, the quantity of crude sulfur ground for pesticides during 1950–51 amounted to 524,000,000 pounds. Of this quantity a rather large amount was exported.

Several factors seem to be in a large part responsible for the lower use of sulfur in 1952. These factors, which we expect will continue in 1953, are:

1. Synthetic organic fungicides and miticides developed recently have been demonstrated to be more efficient than sulfur and are coming rapidly into larger use.

2. Spray concentrates are replacing dusts in extensive areas. Because sulfur cannot be used in these concentrates it has been displaced further by this trend.

3. Information on the need for conserving sulfur appears to have had considerable effect in extending the use of mixtures not containing sulfur.

Copper Sulfate.—Available evidence indicates that copper sulfate requirements, either for direct use as a fungicide or for manufacture of copper sulfate derivatives as fungicides, are between 90,000,000 and 105,000,000 pounds.

Dithiocarbamates.—These synthetic organic fungicides have an important role in the replacement of copper and sulfur. Their use is increasing and is expected to be in the vicinity of 20,000,000 pounds in 1952–53.

2,4-D.—Consumption of this weed killer appears to be increasing steadily. Disappearance in 1950–51 was nearly 24,000,000 pounds. Requirements for the 1952–53 crop year are expected to be at least 28,000,000 pounds and possibly as high as 32,000,000 pounds.

2,4,5-T.—Disappearance of 2,4,5-T in 1950–51 amounted to 2,822,000 pounds. It is believed at least 5,000,000 pounds will be used in 1952–53 and perhaps considerably more than this figure.

Development of new weed killers for particular uses and the increased production of certain materials which have been in use for several years but to less extent than 2,4-D and 2,4,5-T complicates the estimation of weed killer requirements.

Pesticide Estimates

Except for certain specific crops and localities it has not been possible with available facilities up to now to estimate pesticide requirements in general according to the crops to which they will be applied. An exception is the cotton crop for which some rather reliable historical data are available to assist in making such estimates.

For instance, of the total domestic disappearance at the basic producer level during the crop year 1950–51, 20 per cent of the DDT, 66 per cent of the BHC, 94 per cent of the combined disappearance of aldrin, chlordane, dieldrin, heptachlor and toxaphene, 69 per cent of the calcium arsenate, 32 per cent of the parathion and 30 per cent of the TEPP were consumed on the cotton crop that season. ◆

Connecticut Men Rig Up New Spray

Helicopters will become more useful tools for control of agricultural insect pests if new aerial spray equipment developed by two Connecticut men lives up to early promises.

The two men, R. A. Spencer, Connecticut Agricultural Experiment Station, and Samuel F. Potts, U. S. Dept. of Agriculture's Bureau of Entomology and Plant Quarantine, have developed a sprayer which can deliver sprays of any droplet size, from relatively coarse drops to an atomized mist.

Important Features

The new apparatus has other advantages over older aerial boom-type spray. It provides for continuous mixing of spray materials, so that there is no settling and since it permits use of larger nozzles, suspension type sprays may be used.

Spray drip, application of sprays where they are not wanted, is another problem which has been eliminated. Because the new sprayer is substantially lighter than rigs formerly used, it can carry a heavier load of spray material, according to reports.

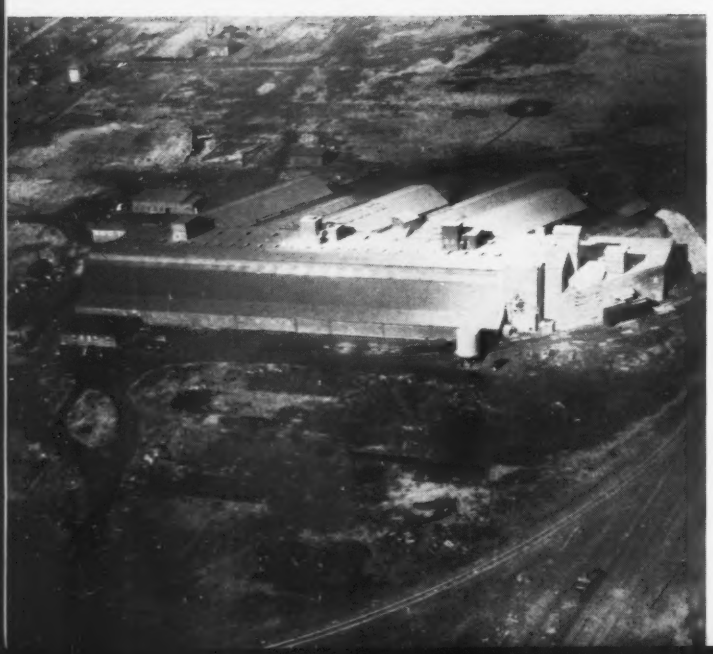
Mounted on each side of the helicopter are 25-gallon tanks. A centrifugal pump supplies the spray to the nozzles. The liquid is atomized by an air blast from the fan used to cool the helicopter's engine. Spray is driven downward at the rate of 12 to 20 miles an hour by the helicopter's rotor.

Several Advantages

Helicopters now provide several advantages for forest and drop spraying. They can reach places inaccessible to ground equipment and are more maneuverable than high and fast-flying airplanes, capable of hovering over the area to be treated.

The apparatus has been field-tested for a year and has successfully controlled several forest tree pests, mosquitoes and insects in cranberry bogs. It has been used to apply hormone sprays to orchards and to apply weed killers.

When the Federal Chemical Co. was still in its youth, primitive "Georgia Buggies" were in use.



Farm Chemicals traces Federal Chemical story to start a new series

They Started

OLDTIMERS at the Federal Chemical company plant in Louisville still like to tell the story about William "Captain" Astroth, who had labor trouble because of his fondness for scaring workers with vivid stories about the origins of the bones they were grinding.

That was long, long ago, of course—in 1884, to be exact—and Federal has come a long way since the days when its business was confined to ground bone, dried blood and animal tankage.

The story of Federal Chemical is of interest to the farm chemicals industry because it is typical of so many others: a meagre start, a history of slow progress beset with frequent and varied problems until today it holds an important position in the industry with modern equipment, technique and products.

The company had its start under George Bradon as the Globe Fertilizer company, with "Cap" Astroth as first plant manager. In 1902 Globe merged with the Tennessee Phosphate Company, and the combination adopted the present name. Mining and processing operations at Mount Pleasant, Tenn., were under Augustus E. Sheldon, a young mining engineer from

The old and the new are illustrated graphically in these photos from the Federal Chemicals files. Middle photo shows original Louisville plant, lower the modern Columbus, O. plant now in use.

Times have changed at Federal. These modern Hough Payloaders save time and money at the plant.

First article in a new series on farm chemicals manufacturers. *See in this issue, page 3.*

With Bones

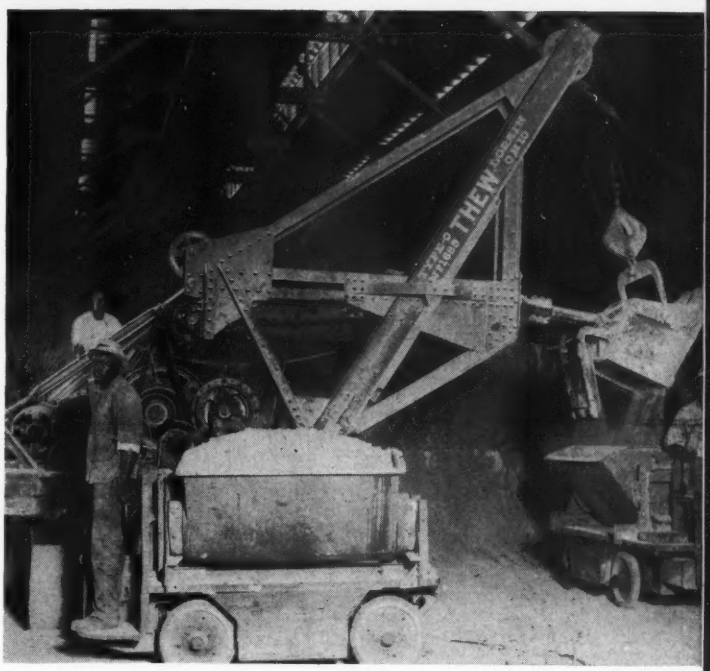
Rutland, Vt., who is credited with pioneering many of the methods in wide use today at a time when phosphate mining was in its infancy.

Federal built a large acidulating and mixing plant in Nashville, and "acid phosphate" soon supplanted bone meal as the basic fertilizer material. That was when Federal met with its first setback—fire in 1914 destroyed the Louisville plant. It was promptly rebuilt on the same site, however, and the company added a plant in Columbus, O., for manufacturing sulfuric acid, superphosphate and mixed fertilizers.

Bradon died in 1923 after guiding the company 39 years and was succeeded by Sheldon. D. S. Miller succeeded Sheldon at Mount Pleasant and Wood Crady was named vice president of the company. Because of his tremendous energy in pushing sales Crady soon became one of the most dynamic figures in the fertilizer industry.

Expansion of the company has been rapid: in the late twenties Federal moved its laboratories from Louisville to Nashville with enlarged staff and facili-

(Continued on page 71)



Early attempts at mechanization are pictured in the middle photo, taken in the middle twenties. Lower photo shows up-to-date mining techniques for phosphate rock in Tennessee.

'Greatest inventory surplus . . .'

NAC Head Discusses Association Problems

Resume of talk presented at 19th annual NAC convention Sept. 3-5, at Spring Lake, N. J.

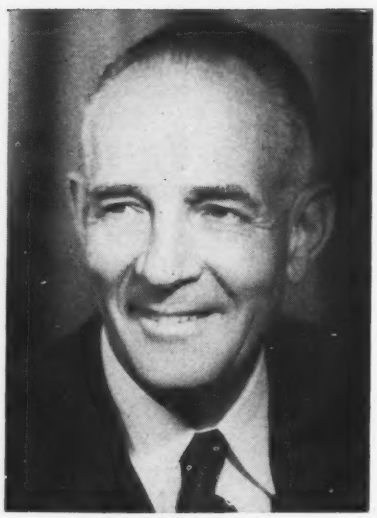
"THE greatest inventory surplus and carry-over problem in the history of this business" was described to delegates at the NAC's 19th annual convention in Spring Lake last month.

Arthur W. Mohr, president of California Spray-Chemical Corporation and head of the NAC, blamed increased production, restricted export quotas, light infestations and the long drought for the inventory problem in his president's address before the assembled delegates.

Some other pertinent information on activities of NAC during the past year and plans for the future were highlighted in President Mohr's talk, a resume of which follows:

Supply and Demand Problems—There has been a tremendous change since last September in the supply and demand picture. The past year has seen completion of a vast increase in plant manufacturing capacity for pesticide chemicals as well as of raw materials required in their manufacture. This has brought about a record breaking production of most of the major insecticides, and by record breaking I mean increases of 50 per cent to double any previous year's production.

On the demand side we have had plenty of troubles. First, the government agencies having to do with export regulations set up rather meager quotas for pesticides for export so the association office and some of the committees devoted a great deal of time and energy working to bring about a relief.



Arthur W. Mohr
NAC President

Our next problem was that of light insect infestations throughout the country and particularly in the southern cotton belt. The widespread drought through the Southeast also had a very derogatory effect on demand.

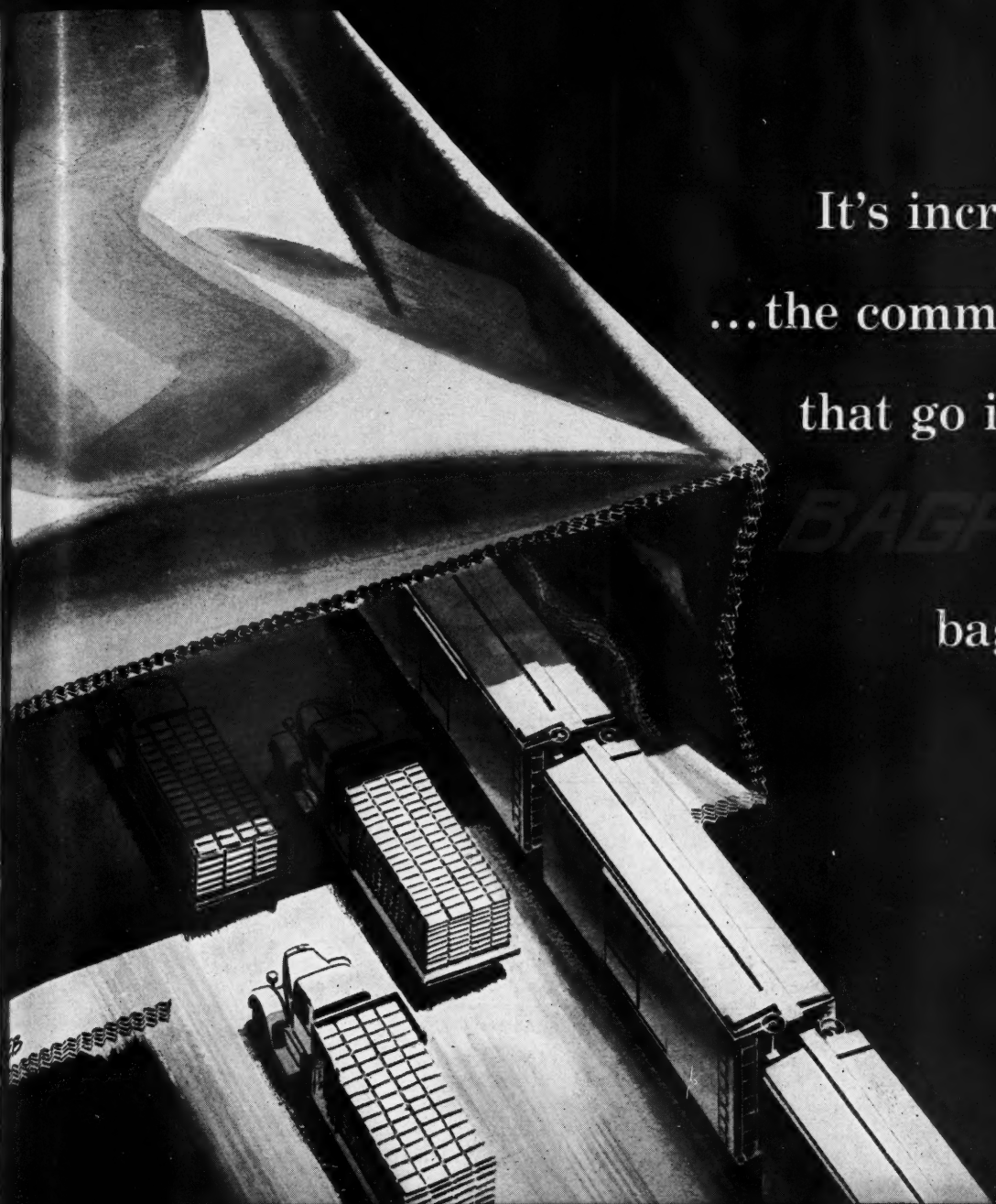
The end result of these circumstances of tremendous increased production, restricted export quotas, light infestations generally and the drought is the greatest inventory surplus and carry-over problem in the history of this business. This is true even though many plants have been shut down for two or three months. It is my personal opinion, that in general there is so much carry-over inventory that there will be no strain on our facilities to handle 1953 requirements.

It is a costly and unhealthy business to have so much money tied up in inventory. Two questions arise: 1. What can be done to alleviate the situation and 2. Is there any way of preventing a recurrence of this very undesirable situation?

In answer to my first question, I would offer two suggestions: First, to work for complete relaxation of export quotas, and second, that we individually and as an association work wholeheartedly to expand the use of our products. There is a vastly increased market open to us if we will sell all potential users on the sound economic gain we have to offer them in the use of our products. A strong widespread educational sales job needs to be done. Such a program should help our oversupply problem.

In answer to my second question as to prevention of a recurrence of oversupply, it has been suggested that information should be available to industry as to inventories of chemicals on hand at the end of each month. Industry could then work more intelligently to fully supply the needs of domestic agriculture and the foreign market and at the same time to not overproduce by tremendous margins, as has been the experience this year.

Delaney Committee—Last fall and early this year the Delaney Committee continued hearings preparatory to rendering its report. The association carried on an active campaign to get the best possible



It's incredible! ...the commodities that go into a BAGPAK bag

Polystyrene—Feeds—Calcium Chloride—Salt—Ammonium Nitrate—Cement—Rosin—Fertilizers—Sugar—Flour—Insecticides—Fine Chemicals—Clays—Rock Wool—and over 400 other products costing from less than a cent a pound to over a dollar a pound are being packed in Bagpak Multiwall Paper Bags.

Bagpak also furnishes Bag Closing Machines. For details about bags and machines write to Bagpak Division, International Paper Company, 220 East 42nd St., New York 17, Dept. A-7

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testimony submitted to the committee during the hearings. The committee has now issued its report and as most of you are aware, the majority report is unfavorable to our best interests. A minority report was submitted which is highly favorable.

Congressman Delaney has indicated that he is going to introduce new regulatory legislation at the next session of Congress. We are fearful it will be of radical nature and against our best interests which may necessitate a great deal of effort on our part to either defeat it or amend it.

Establishment of Residue Tolerances—The Association has continued to press for the issuance of tolerances on food by the Food and Drug Administration. I can report that other organizations are actively trying to get the regulations issued. Our efforts will be continued.

Product Liability—This problem is a never ending one of serious nature. A comprehensive study of all reported court decisions involving liability arising from the manufacture and sale of chemical products including pesticides has now been completed and published. This was a joint venture with the Manufacturing Chemists' Association. The manual is available to our membership at a cost of $15. It is highly recommended that all member companies procure a copy as it is felt that the information will be of very substantial value as a guide to determining the best procedures in case of liability claims and suits.

Traffic and Transportation—As most of you are aware, our Traffic Committee through the years has done a splendid job in working out freight reductions which have saved us large sums of money. At present they are preparing to combat any proposal of the rail carriers to cancel Column 26 Exception Ratings we now enjoy under the present uniform freight classifications and to put into effect Column 32½ which would greatly increase our freight costs. We have some highly capable people on this committee, and I am sure they have our full confidence.

Credit Survey—Last year the board authorized a credit survey of our membership. This was completed in the fall. A report was sent to all members who participated in the program. It has been felt by many of our members that as an industry we have been considerably more lax than most other industries serving the agricultural trade.

It hardly seems fair and right that the average farmer will pay his seed, machinery, fertilizer and other bills first and settle for his insecticides after satisfying all other calls for his money. Last year's survey indicated a general weakness which would seem to pretty well substantiate this situation. Another survey will be taken this fall and it will be of interest to see if we as an industry have improved our position.

State Legislation—During recent years there has been a rash of new legislation introduced into the state legislatures throughout the country. Many proposed laws were very restrictive and highly detrimental to our best interests. The magnitude of the problem became so acute that it was impossible for the Washington office staff to personally handle the situation.

For other news about the National Agricultural Chemicals Association, see pages 14 and 31.

United Nations and World Health Organization Program for Construction of DDT Plants in Foreign Countries—As soon as we became aware of the fact that the United Nations and our State Department had approved the use of American dollars for the construction of four DDT plants in various foreign countries, we organized a vigorous campaign to block this action.

Numerous meetings were held with the various authorities and strong protests were registered. Commitments had advanced so far that these plants probably will be built. We are hopeful, however that the work of our Washington staff and our committees has deterred building of others.

New machinery has been set up in that we now have 36 volunteers from industry who serve as legislative coordinators in the various states. The association has prepared a manual which outlines our legislative policies with suggested procedures of presenting our position to legislative bodies and regulatory officials. The manuals have been furnished to the coordinators. These volunteers are located throughout the country and in most cases have close local affiliations which we feel should be very effective. Some fine work has been done through these channels this year.

Speakers' Bureau—The Speakers' Bureau was established and I am pleased to report that many of our people volunteered for speaking assignments. We furnished speakers to a large number of meetings throughout the year, which I am sure has been helpful to our best interests.

Publications and Reports—Our Washington office has continued throughout the year its pest reporting service, the bulletin service, the publication of NAC News, the preparation of publicity releases and distribution of defense production releases. This work has required a very considerable amount of time by the staff.

Regional Meetings—In February of this year a Midwest regional meeting was held in Chicago for the benefit of those in that area who were particularly interested in the activities of the association. Mr. Hitchner and I attended and were gratified by the expressions of those in attendance as to the value of the meeting.

The spring meeting in San Francisco seemed to be a very successful one, judging from the comments of those who attended and the many expressions sent to the Washington office after the meeting. Largely because of the splendid attendance and success of the San Francisco meeting, the board decided on a policy of holding spring meetings at different spots throughout the country. New Orleans was selected for the spring of 1953. It is felt that this policy will strengthen the association, as it will bring first-hand information to the smaller companies who may not attend the annual fall meeting. ◆

ANNOUNCING

NEW Uses for PARATHION

The most widely effective of all insecticides now gives even wider coverage

New claims accepted by the U. S. Department of Agriculture for labeling purposes are listed below:

ALFALFA
Alfalfa caterpillar

APPLE
European sawfly
Leafhopper
Pear borer

APRICOTS
Pandemis moth

BERRIES
Blackberries:
Red-necked cane borer

Boysenberries and dewberries:
Aphids
Red spider mite

Cranberries:
Lecanium scale crawler

Currants and gooseberries:
Aphids
Red spider mite

Raspberries:
Aphids
Red spider mite

CABBAGE, MUSTARD, TURNIP, KALE, RADISH AND CARROT
Vegetable weevil

CHERRY
Casebearer
Fruit fly
Leaf miner
Pandemis moth
Red spider mite
San Jose scale crawler
Shot-hole borer

CITRUS
Aphids

CORN
Budworm
Corn earworm
Leaf aphid
Fall armyworm
Sap beetle

CUCUMBER, SQUASH AND MELONS
Stink bug
Vine borer

GRAPES
Grape berry moth

LETTUCE
Aphids
Leafhopper

ORNAMENTALS (outdoors)
Bagworm
Cottony-cushion scale
Juniper webworm
Lace bug
Lecanium scale
Thrips

PEACH
Lecanium scale
Red-banded leaf roller
Shot-hole borer

PEAS
Pea weevil

PECAN
Black pecan aphid
Nut casebearer
Red spider mite
Twig girdler
Walnut defoliator
Webworm
Yellow aphid

PINEAPPLE (before planting)
Mealybug

PINEAPPLE (treatment of beds)
Mealybug
Cricket

POTATO
Armyworm

PRUNE AND PLUM
San Jose scale crawler

SOYBEAN
Velvetbean caterpillar

TOBACCO (seedbed)
Flea beetle
Midge larvae
Vegetable weevil

TOBACCO (field)
Flea beetle
Hornworm
Vegetable weevil

TOMATO
Armyworm

Consult local agricultural authorities for suggestions on dosages and application procedures.

AVAILABLE FROM NATIONAL MANUFACTURERS

AMERICAN Cyanamid COMPANY

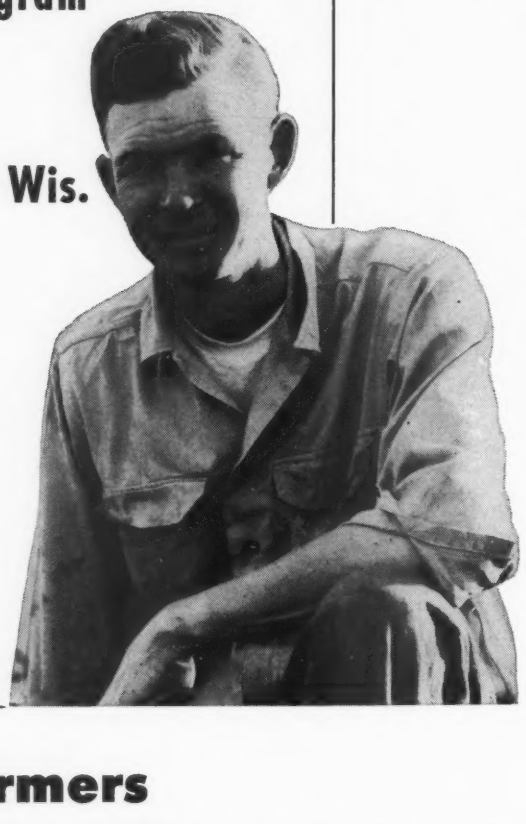
Manufacturer of Thiophos® Parathion Technical

Agricultural Chemicals Division
30 Rockefeller Plaza, New York 20, N. Y.

Write for new 1952 Parathion Grower's Handbook

ATTENTION DISTRIBUTORS AND DEALERS: Are you taking advantage of the sales opportunities offered by parathion insecticides? If not, get in touch with a manufacturer whose products contain THIOPHOS Parathion. List of manufacturers on request.

High-nitrogen fertilizer program for corn nets $21.59 more per acre for Lee Andrews, Grant County, Wis.



● Here's another young farmer who found out for himself how well a high-nitrogen fertilizer program pays off.

Lee Andrews of Grant County, Wis., broadcast and plowed down 800 pounds of 8-8-8 fertilizer per acre and applied the usual amount of row fertilizer. Comparing the corn yield with that from an unfertilized test plot, he found that this program gave him a net return of $21.59 *more* per acre.

Cooperating with Mr. Andrews in this experiment were George Dehnert, former Grant County Farm Agent, and Prof. C. J. Chapman, of the Department of Soils at the University of Wisconsin.

Bigger yields for farmers mean better business for you

● Experiences like these are convincing evidence to farmers that high-nitrogen complete fertilizers are a paying proposition. The bigger yields pay the fertilizer cost many times over.

And experiences like these are the reason why you're finding the demand for high-nitrogen fertilizers climbing steadily. You're missing a good bet if you're not giving these fertilizer grades special promotion efforts.

You have an extra selling point when you use U·S·S Ammonium Sulphate to supply the nitrogen in these grades. This dry, free-running nitrogen material mixes easily, stands up in storage and handles well in drills or other distributing equipment.

If you'd like more information on U·S·S Ammonium Sulphate, contact our nearest Coal Chemical Sales Office or write directly to United States Steel Company, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

U·S·S AMMONIUM SULPHATE

USS

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UNITED STATES STEEL

How You Can Get

Free Information

On each of the two postage-paid postcards below you can request further information on four items described on this and the Industrial News section of this issue. ***Fill out one quarter section for each item in which you are interested.***

10-3 Iron Complexes

Sequestrene iron complexes, sold by Geigy, are credited with correcting one of the most difficult to control mineral deficiencies—iron chlorosis. Tests of formulations on citrus have worked wonders in bringing back to production crops that were dying. A technical bulletin covering the metal complexes of Sequestrene in plant nutrition and pamphlets on iron chlorosis in citrus are available along with reprints of papers by Stewart and Leonard and Jacobson. **Code Number 10-3.**

10-4 Bag Holders

A new two-color, six-page brochure covering four types of bag holders is available from Richardson Scale Co. The holders are used to secure bags to hopper outlets during filling. Photographs and operating details are included as well as recommended applications for clamp, inflated-ring, cable and cam grip types of holders. **Code Number 10-4.**

10-5 Belting Bulletin

A new eight-page bulletin describing its conveyor has been prepared by Barber-Greene Co. The bulletin shows how B-G construction is designed to combat the major causes of belt failure, including ply separation, carcass deterioration, irregular plies, edge wear and longitudinal seam failure. **Code Number 10-5.**

10-6 Mead Mill Pulverizers

The complete line of Mead Mill high speed impact pulverizers is described in a new booklet from the company. Typical grinding and ungrindable materials pulverized by the mills are listed, including several in the farm chemicals industry. Detailed drawings give dimensions of all five mills with horsepower ranges from one to 30. **Code Number 10-6.**

Here is a list of the NEW PRODUCTS and BULLETINS described on this and the Industrial News pages of this issue giving their monthly code number.

10-1	Elevator Boot
10-2	New Pump
10-3	Iron Complexes
10-4	Bag Holders
10-5	Belting Bulletin
10-6	Mead Mill Pulverizers
10-7	FlexSpout Closures
10-8	Hi-Sil
10-9	Heptachlor
10-10	Aquafil Conditioner
10-11	Webster Bucket
10-12	Preform Multiwalls
10-13	Armour Emulsifiers
10-14	Jenkins' Valves
10-15	Grommet Belts

FILL OUT READER SERVICE CARDS

FARM CHEMICALS Code Number

Name.....
Title.....
Company.....
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Co. Address.....
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FARM CHEMICALS Code Number

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FARM CHEMICALS Code Number

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10-7 FlexSpout Closures

FlexSpout closures for steel pails have many features the customer likes. They are leakproof, open without any special tools, extend and flex for ease in pouring, and re-seal tightly to protect volatile liquids. Unit can be furnished on pails from most manufacturers. It permits faster filling and sealing, lowers production costs and adds sales appeal to the product. Details, prices and a sample are available. **Code Number 10-7.**

10-8 Hi-Sil

Tests completed on Columbia-Southern Hi-Sil has shown the material to be an excellent carrier in 75 per cent DDT dusts and wettable powders. A very finely divided hydrated silica, the material makes possible highly concentrated DDT powders. The study is now available for your inspection through a paper just released which discusses the findings in detail. **Code Number 10-8.**

10-9 Heptachlor

Heptachlor, Velsicol's new insecticide, now is fully approved for use in combatting insect pests. Applied in wettable powders, emulsifiable concentrates or dusts as little as four ounces per acre will do an effective job for boll weevil control. This application also controls a variety of other cotton pests. **Code Number 10-9.**

10-10 Aquafil Conditioner

You don't have to worry about tombstoning your mixed goods if Aquafil is used as a conditioner, according to the manufacturer. Two years of research have shown the diatomaceous earth product to be four times as effective as old type conditioners. A more uniform and concentrated product is obtained when Aquafil is used and there are additional savings in handling labor. **Code Number 10-10.**

10-11 Webster Bucket

A new bucket, specially designed for handling both wet and dry fertilizers now is available for your handling equipment. The Webster bucket provides more metal at points receiving most strain and wear. There are extra months of service and less down time. **Code Number 10-11.**

10-12 Preform Multiwalls

Preform multiwall bags from Bagpack Division make bag top forming easier and speed up your closing operations. A built-in crease permits the tops to be prepared for closing easier, faster and neater. In addition, bag lengths can often be reduced. **Code Number 10-12.**

10-13 Armour Emulsifiers

Emulsification of pesticides is easier, faster and longer lasting when you use Armour Etho-Chemicals. Two mildly cationic types combine to form an excellent emulsion for 2, 4-D isopropyl ester, even in very low concentrations. Another can be used to emulsify chlordane directly in water without a solvent. Formulas, methods of use and prices for the complete line are available. **Code Number 10-13.**

10-14 Jenkins' Valves

To end high valve mortality from corrosive liquids and to control fluids which must be kept free from contamination or discoloration, stainless steel is the right metal. However, it takes more than metal to make a valve. Jenkins Bros. assures dependable performance with its two-way hookup-stainless steel. The company has available a free folder describing its complete line of valves. It contains specifications and other important data which will help in selecting the right valves for your plant. **Code Number 10-14.**

10-15 Grommet Belts

Three big savings can be had in farm chemicals plants merely by using B. F. Goodrich grommet belts, according to a bulletin from the company. You save belt costs because belts last longer, production costs because machines keep running with fewer interruptions and maintenance costs because they need less attention. The belts represent the only basic change since invention of the V belt, according to the company. They last 20 to 50 per cent longer, depending on service. **Code Number 10-15.**

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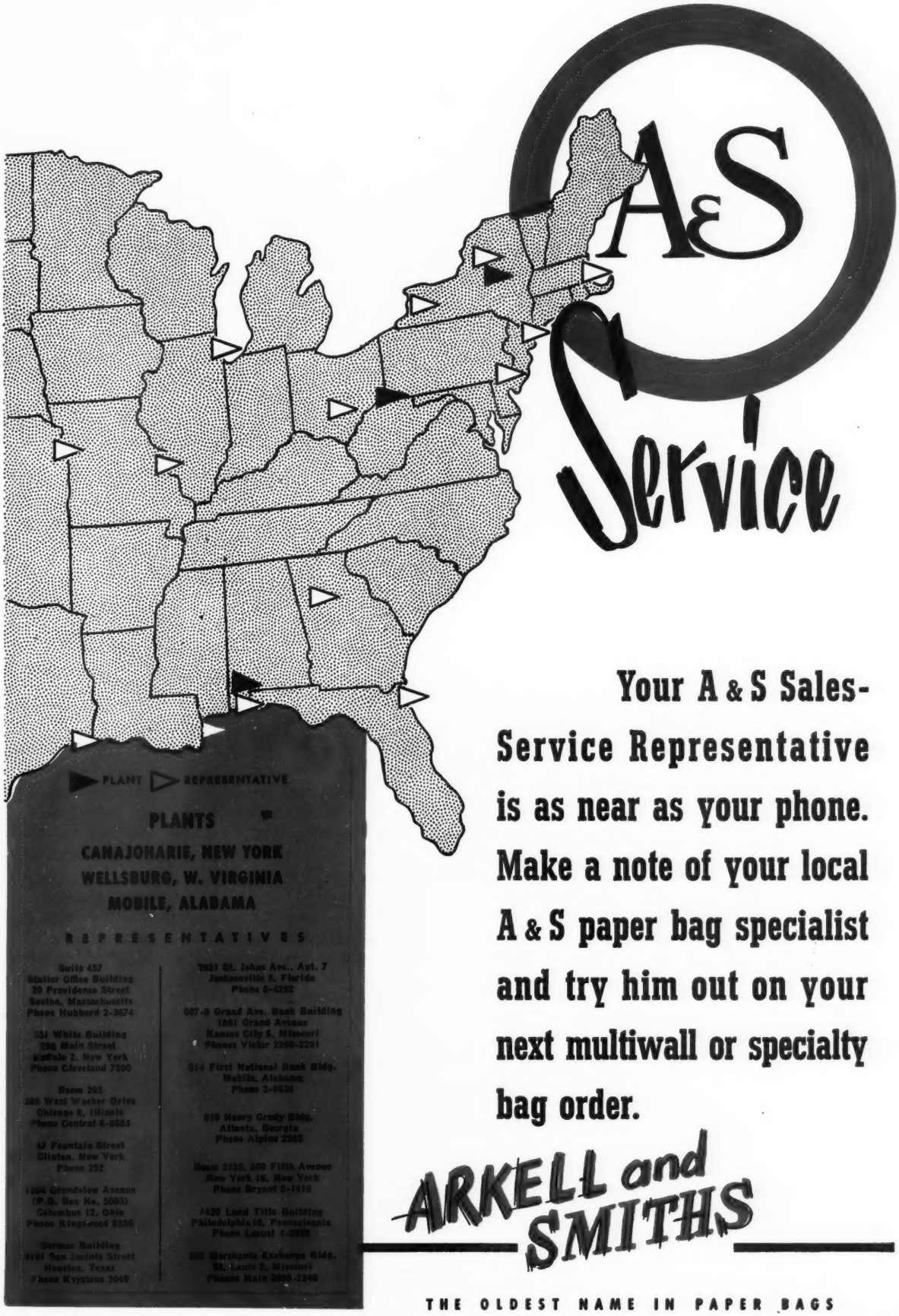
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Pesticide manufacturers face scores of problems in putting a product on market. Biggest one is—

Nick Lazaneo, foreman, watches spray pattern of material applied to prune trees at DuPont company's research farm near Cupertino, Cal.

How Will It Work?

Farm Chemicals Staff Report

WILL our new pesticide control insects, diseases or weeds at a cost which will make it profitable for the farmer?

Will it damage crops if used carelessly? Can it be applied with safety to the operator, and will it leave a hazardous residue on the crop at harvest time?

These are some of the vast number of questions farm chemicals manufacturers ask themselves every time they prepare to release a newly developed pesticide for commercial use.

Questions Facing Manufacturers

The questions always have faced manufacturers. That's why they perform such exhaustive research and testing of products before giving them the final clearance for marketing.

One particularly difficult nut to crack is determining just how a pest control chemical will behave in a given geographical region of the country.

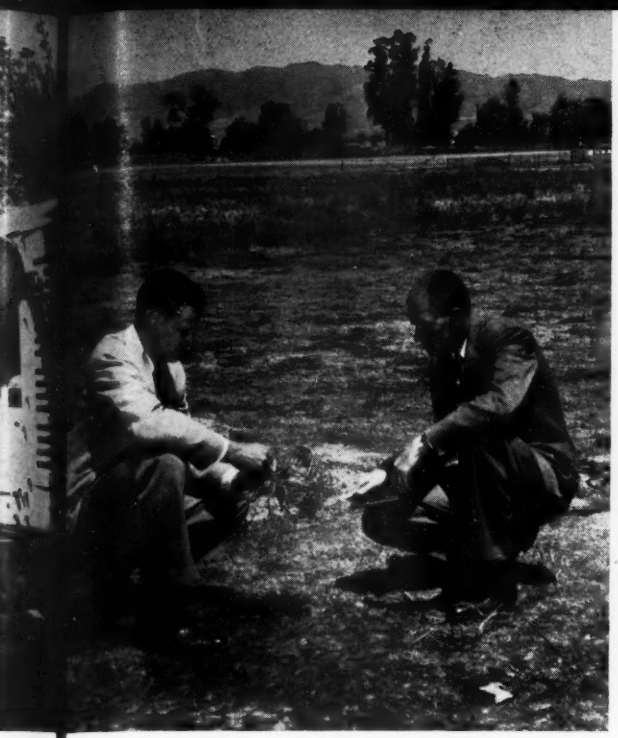
With more new chemicals for agriculture developed during 1951 than in any similar period in history, great attention must be focused on the question.

The DuPont company has come up with a novel and workable solution to the problem of geographical testing of new pesticides. They have established a far western experimental farm for testing their products.

The farm, or experiment station, is located a mile south of the little town of Cupertino, Cal., and consists of 15 acres of orchard and field crops which annually receive treatments given no other farm land on the West Coast.

San Jose Experimental Station

The area is called the San Jose Experimental Station. It was purchased by DuPont in the fall of 1948 after more than a year of studying climatic conditions,



Left: Effects of DuPont's new CMU herbicide are examined by F. H. McDiarmid, left, and L. F. Taylor, research investigators at the San Jose Experimental Station, where test plots determine product effectiveness. Right: M. C. Swingle, in charge of the experiment station, discusses discing of cover crop with Nick Lazaneo.

farming practices and insect, disease and weed problems of the far western states. The location in the fertile Santa Clara Valley is ideal—it affords an opportunity to work with a wide range of crops, from semi-tropical plants and citrus to apples, pears and other crops.

Growing on the land are tree crops including apricots, walnuts, peaches, almonds and pears and raspberries, strawberries and grapes. Another area is planted each year to a variety of vegetable crops.

Millard Swingle, in charge of the experimental work, explained that this diversification is necessary to provide a range of plants for testing chemicals.

Here's how the system works:

Farm crops serve as an initial proving ground for new chemical compounds developed through DuPont research.

If the compounds perform well at the San Jose Experimental Station they are next tested under large-scale operation methods throughout six western states.

Consider Cooperative Tests

These are cooperative tests conducted with progressive farm and ranch operators, to determine whether the chemical will do its job under typical commercial practices.

The DuPont research team isn't satisfied to get only the results of its own testing. It keeps in close contact with federal and state investigators, including U. S. Department of Agriculture representatives in the area, state college experiment station personnel and extension service workers.

In fact, many of the actual field tests are conducted in cooperation with such investigators.

DuPont makes supplies of new compounds available to the state and federal experimenters for their own evaluation. Experimental dosages of the chemicals are determined by conferences and the exchange of test data.

Swingle's Background

Swingle has an excellent background for supervising activities at the San Jose Station.

A graduate of Ohio State University, he spent 15 years with the U.S.D.A. and four years at DuPont's pest control research laboratory in Wilmington, Del., before going to the West Coast in 1947 as area supervisor for the company's agricultural product development section.

Assisting Swingle are three other DuPont agricultural specialists. Lyall F. Taylor and Fred H. McDiarmid have headquarters at the Cupertino farm while C. R. Hunt covers the Pacific Northwest from his field headquarters at Corvallis, Ore.

Swingle and his staff spend much of their time traveling the western countryside, arranging for tests, observing application of chemicals, studying the materials on crops and evaluating the results.

Covers Six States

The program encompasses the six states of Washington, Oregon, Idaho, Nevada, California and Arizona.

The San Jose Experimental Station, together with the diverse field investigations, is an excellent model for the farm chemicals industry in its efforts to determine as accurately as possible the performance and effectiveness of new pesticides before they are put on the market. ◆

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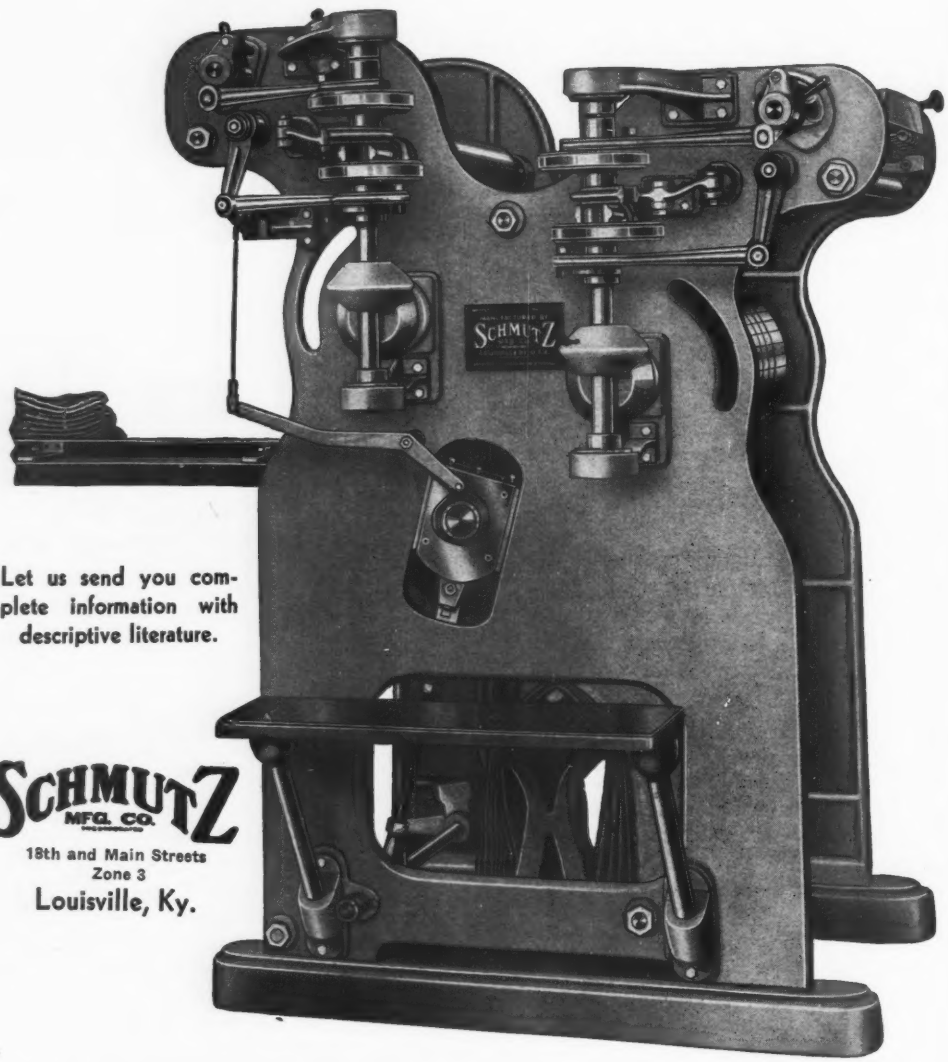

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Many industry problems aired in presentation of

Fertilizer, Pesticide Papers at ACS Meeting

Following are some of the abstracts of papers presented at 122nd national meeting of American Chemical Society in Atlantic City, N. J., Sept. 14–19, of interest to farm chemicals industry. Remainder will be presented in November FARM CHEMICALS.

Fertilizer Abstracts

"Fertilizer Expenditures in Relation to Income in Various States." A. L. Mehring, J. R. Adams, and Gae A. Bennett, Division of Fertilizer and Agricultural Lime, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

—

Farmers on the average during the past 40 years have spent close to five cents out of every dollar of income from crops and government payments for fertilizer. During all the years from 1910 to 1950 the highest average for any year was 6.7 cents in 1914 and the lowest was 3.1 cents in 1921.

Crop income increased from $3 billion in 1912 to $13 billion in 1950 and farmers increased their expenditures for fertilizer from $153,000,000 to $700,000,000 in the same period. In 1912 farmers used 157,000 tons of nitrogen, 521,000 tons of P_2O_5 and 222,000 tons of K_2O. In 1950 they consumed 1,126,000 tons of nitrogen, 2,072,000 tons of P_2O_5 and 1,215,000 tons of K_2O. The average cost of a ton of plant food, therefore, declined from $170 in 1912 to $159 in 1950.

In the southeast, farmers spend relatively less of their income than formerly for fertilizer. For example South Carolina planters spent on the average 20.27 cents out of each dollar of income from crops and government payments in the 15 years from 1925 to 1939, inclusive, but only an average of 16.29 cents in the 11-year period 1940 to 1950.

Farmers of Massachusetts, Pennsylvania, Ohio and Indiana have continued to spend about the same proportion of their income, although 1950 expenditures were a little higher than the average for the entire period. The farmers of California and Texas are now spending more than twice as large a proportion of their income for fertilizer as prewar.

The greatest increases occurred in the north central states, where the average expenditure in the 15 years before World War II was only a few tenths of a cent out of each dollar. In 1950, the averages for Minnesota, Iowa, Missouri and Kansas were 3.02, 3.15, 6.62 and 2.01 cents, respectively.

"Potential of Fertilizer Use for More Efficient Crop Production as Applied to the Northeastern Region." Mack Drake, University of Massachusetts, Amherst, Mass.

—

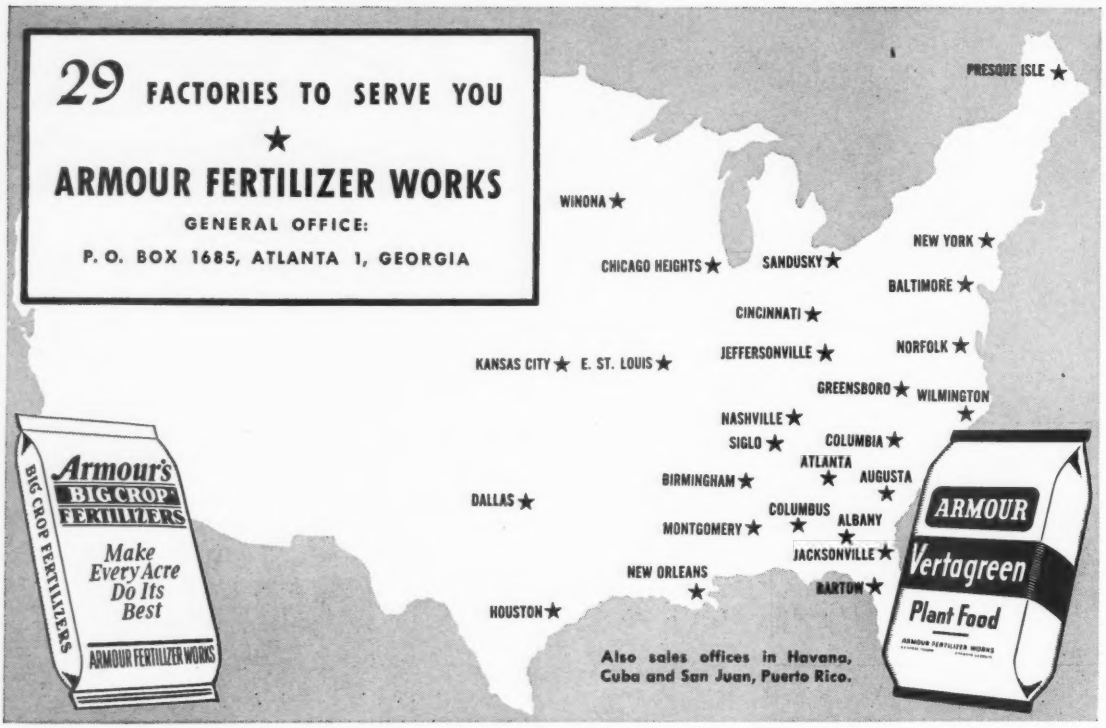
Data from hundreds of fertilizer experiments have been assembled through the cooperative efforts of state and federal soil scientists and soon will be published. These data show the possibilities of much larger crop yields and greater efficiency in crop production by the proper use of plant nutrients. However, the supply of fertilizer materials, especially phosphorus, appears inadequate to approach those tremendous crop yield potentials.

More effective use of our current supplies of fertilizer materials will be required in the future for more efficient crop production. This will require increased research effort for fundamental knowledge of (1) factors affecting availability of fertilizer nutrients in the soil and (2) how plants feed in native, residual and applied mineral nutrients.

While fundamental research in soil-plant relationships requires a vast amount of planning and effort, once fundamental truths have been uncovered, their application can produce such far-reaching effects as "the two pounds of nitrogen for one bushel of corn" relationship.

Historically and current nitrogen, P_2O_5 and K_2O usage per acre is much higher in the northeastern region than in any of the other regions. Experimental crop yields responses produced by nitrogen, P_2O_5 and K_2O fully justify increasing the current acre applications for all except a few crops. Fundamental information is essential to understanding why high annual applications of fertilizer are so necessary in the Northeast.

When soluble phosphate fertilizers are applied to soils of the humid region, active iron and aluminum in the soil react to form relatively insoluble "fixed" phosphates. Soils of the northeastern region are much higher in active iron and aluminum than soils of



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the other regions and thus much larger applications of phosphate fertilizers are required to supply a given level of available phosphorus to plants in this area.

Increased efficiency in the use of phosphorus can be attained by proper use of manure and other organic matter which both reduces phosphorus fixation and increases the availability of fixed phosphates by inactivating the iron and aluminum in the soil by formation of stable Werner type complexions.

Many soils of the northeastern region are low in cation exchange capacity and in potassium minerals. Soils of this Northeast region do not receive an annual deposit of potassium-bearing loess as do many areas in the Midwest, so large annual applications of potash fertilizers are needed. Factors affecting more efficient crop production by potassium and nitrogen are discussed. Forage crops offer the greatest potential use for increased applications of fertilizers in the northeastern region.

"Potential of Fertilizer Use for More Efficient Crop Production as Applied to the Middle West." K. C. Berger, University of Wisconsin, Madison 6.

The present status of fertilizer use and its relation to crop yields in the north central region were discussed in a report by the Fertilizer Work Group of the National Soil and Fertilizer Research Committee in July 1951. The report shows that present yields of the most important crops are from one half to two thirds of the yield potential with full fertilization. For example, corn yields on the average 44 bushels, which is only two thirds of the potential with full fertilization.

Yields are especially low in the western part of the region where rainfall often is limited, but even here only 40 per cent of the yield potential is reached under present-day management. With proper fertilization, it is estimated that in the heart of the Corn Belt state, average yields would reach 75 to 80 bushels per acre. With full fertilization of corn, yields could be increased approximately 800,000-000 bushels in this region without increasing acreage.

At present in the region, wheat is yielding one half of its potential with full soil fertilization. With proper application of nitrogen, phosphate and potash, fertilizer yields of wheat could be increased over 600,000,000 bushels annually.

Oat yields throughout the region have been low, averaging 35 bushels per acre. This is somewhere between one half and two thirds of the potential of this crop. With proper fertilization, yields could be increased over 700,000,000 bushels on the same acreage at present.

Hay yields throughout the area are very low, and hay as a general rule is producing less of its potential than any of the other major crops. Present yields average about 1.5 tons per acre. It is estimated that those yields could be increased to slightly over 3 tons per acre, with some states having as an average yield as much as 4 tons. This would mean the production of about 50,000,000 additional tons of hay on the same acreage as present.

"Potential of Fertilizer Use for More Efficient Crop Production as Applied to the Humid South." James A. Naftel, Pacific Coast Borax Company, Auburn, Ala.

For agriculture to keep pace with other segments of our economy, it becomes increasingly important that all controllable factors in crop production be considered from the standpoint of efficiency. The use of adequate and proper fertilizers to attain the highest possible efficiency is the point discussed here.

As an example of greater efficiency in crop production through the use of adequate fertilizers in the humid South is the sharp increase in corn production in North Carolina brought about in recent years through more adequate fertilization, as well as other necessary production factors.

Grassland farming as now being practiced by better farmers offers perhaps the most striking example of how adequate fertilization and rotation of combinations of deep-rooted legumes and grasses is bringing about more efficient crop production as well as more total production. A specific instance is where the oat yield of an old worn-out cotton farm was approximately 30 bushels per acre until this crop followed a 4-year alfalfa crop that had received annual application of approximately 1000 pounds per acre of high grade complete fertilizer containing trace elements. The first two crops of oats following the alfalfa were 80 and 95 bushels, respectively.

Approximately 3-fold increases in yield resulted without additional overhead, obviously a better chance for profit through greater efficiency. Perhaps this is an answer to the increasing concern over the future requirement of much greater agricultural production on practically the same acreage.

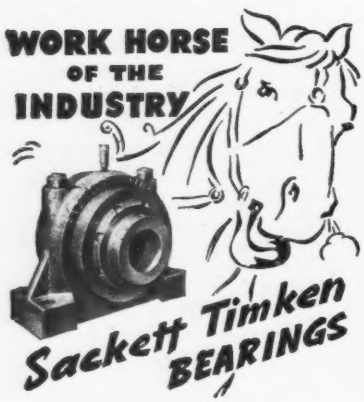
"Scrubbing Systems for Fluorides in Superphosphate Plants." A. B. Pettit, Davison Chemical Corp., Baltimore 3, Md.

Fluorine compounds are evolved during acidulation of phosphate rock to produce superphosphate. Mellor rates fluorine as the most chemically active element known. Because of this characteristic, it will insist on combining with other elements found in phosphate rock and is evolved in the form of fluorides, never as elemental fluorine.

Scrubbing with water has been found to be an effective means of controlling emissions of these fluorides. Variations of scrubbing systems using water alone and in combination with a lime slurry are described.

"Foliar Applications of Plant Nutrients to Vegetable Crops." R. L. Isaacs, Jr., and J. B. Hester, Dept. of Agricultural Research, Campbell Soup Co., Riverton, N. J.

Urea spray with a suitable wetting agent applied to the foliage in the regular spray program for insects and disease control has proved very effective in supplying nitrogen to certain vegetable crops. Urea and ammonium nitrate in equal mixture can be used for certain vegetable crops at a greater



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Pesticide Abstracts

concentration than either material alone.

"Introduction to Problems of Chemical Weed Control." C. E. Minarik and A. G. Norman, Chemical Corps Biological Laboratories, Camp Detrick, Frederick, Md.

—

Chemical weed control in a diversity of forms has greatly developed during the past few years, but as yet its potentialities are far from being fully exploited. Herbicides exercise lethal or growth-controlling effects in various ways, but in most cases little is known as to their physiological modes of action. Their employment at present is, therefore, essentially empirical, though often dramatic.

Basically there are two sets of circumstances under which chemical weed control is practiced. In the first the objective is control of all vegetation or suppression and eradication of undesirable species; in the second weedy species must be eliminated from land that is concurrently planted with a productive crop, or will shortly be so planted.

In the former case, greater latitude is possible than in the latter where the requirement of differential responsiveness in weed and crop plants poses many interwoven biological problems. Prevention of weed seedling establishment may well be preferred to the later control of weeds that have already competed with the crop.

In the search for new herbicidal chemicals for vegetation suppression or eradication high potency and broad herbicidal properties may be emphasized. When weed control in crop land is the objective, the tests applied may be aimed at recognition of inherent differences in responsiveness between crop and weed species.

"Some Considerations in Choosing Herbicide Application Methods." K. C. Barrons, The Dow Chemical Co., Midland, Mich.

—

Herbicides are chemical tools useful in controlling weeds and unwanted vegetation. Like any tool, each herbicide must be used in the right way, at the right time and in the right place in order to be most effective. Choosing the best chemical for a given problem and formulating it properly are obvious first steps, but equally important is the choice of application method.

Questions of timing, volume, spray pattern and pressure are but a few of the factors that must be considered before choosing application methods and application equipment. A number of theoretical considerations must be taken into account in choosing an application method, just as these same considerations must be given their due weight in the choice of herbicide and formulation.

Some of the factors that must be considered are:

1. Mode of entry of the herbicide into the plant.
2. Nature and extent of translocation within the plant.
3. The nature of plant responses to the herbicide.
4. Variations in species and varietal response.
5. Effects of stage of growth and the physiological condition of the plant.
6. Effects of atmospheric environment.
7. Relative persistence of the herbicide in the soil.
8. Effects of soil environment on availability, leaching and absorption.
9. Possible contamination effects adjacent to treated areas.
10. Toxicological considerations.

"Mechanisms of Action of 2,4-D." Robert L. Weintraub, Chemical Corps Biological Laboratories, Camp Detrick, Frederick, Md.

—

Although there exists a considerable body of observations relating to the morphological, physiological and biochemical effects of 2,4-D on plants, it has not been possible as yet to integrate this information into a unified picture of mechanism of action.

The paper attempts to summarize a portion of this knowledge

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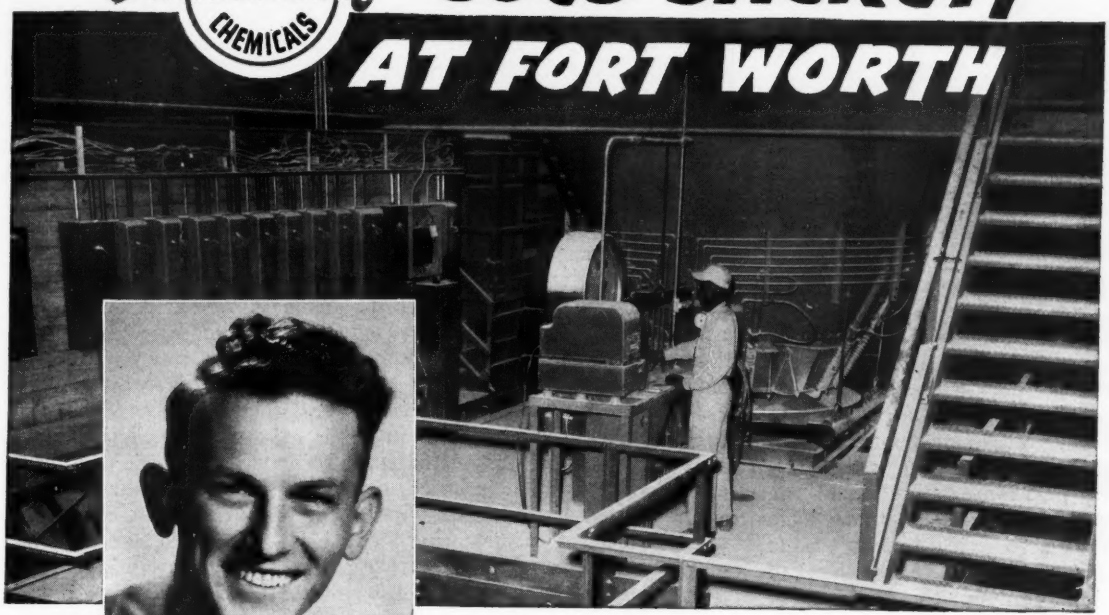

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and to discuss also studies of the relationship between activity and chemical structure of related growth regulators, of the interactions between 2,4-D and endogenous growth regulators, and of the in vivo transformations of 2,4-D which may be expected to contribute to final solution of the problem.

"Mode of Action of Herbicides Other Than Aryl Oxy Alkyl Acids." V. H. Freed, Agricultural Experiment Station, Oregon State College, Corvallis, Ore.

The field of weed control by comparison to those of plant pathology and entomology still is in its infancy. Tremendous developments have accrued in the practical or applied side of this field since the advent of 2,4-dichlorophenoxyacetic acid. Fundamental knowledge regarding the action of the powerful chemicals that have been placed in the farmers' hands has not received due attention. It is only through this fundamental knowledge that further advancement of this field may be brought about.

Attention has been focused in recent years upon the mode of action of 2,4-dichlorophenoxyacetic acid used either as an herbicide or as a physiological growth regulant. However, a number of other new highly active organic chemicals are rapidly taking their place in the field. In order to use these materials intelligently and to serve as a basis of development of even better materials, it becomes necessary to understand the mode of action of these chemicals.

It is patent that a chemical, in order to exert an effect on the plant, must act through one or more of the enzymes in the organism. There are several mechanisms by which chemicals may affect the plant, ranging from outright precipitation of the apoenzymes, as in the case of the heavy metals, through more subtle effects of competition.

It is necessary to remember in dealing with whole organisms, however, that the physical chemistry of both the compound and the organism, as well as the morphochemistry and cytochemistry of the organism, will be interrelated to the ultimate effect of the chemical. It becomes important, therefore, to keep in mind factors such as membrane potential, ionization, distribution phenomena and adsorption phenomena, when studying the effect of a chemical on a plant.

Animal toxicology often points the way for the study of the effect of certain chemicals on plants. Thus, it has been demonstrated in animals, that arsenicals produce their drastic effects through covalent bonding with sulfhydryl groups of dehydrogenases and similar enzymes. Analogous work with plants has tended to bear this out. Similarly, high-sulfur plants, such as the legumes, are more susceptible to arsenicals than are low-sulfur plants.

Sodium chlorate has long been extensively used as a herbicide, but as yet no one has discovered its exact mode of action from an enzymatic point of view. A number of studies of factors influencing the effectiveness of this compound have been made, but unfortunately little concern has been felt over the exact nature of its action once ingested by the organism. It has been demonstrated, however, that catalase activity of affected plants is markedly lower. Similarly, respiration is found to increase with a subsequent decrease of reserve carbohydrates. It has been speculated that the chlorate ion is not toxic per se, but rather its reduction product, chlorite and hypochlorite ions are most effective. Nitrates, however, tend to overcome the toxicity of chlorate.

Many of the new organic compounds such as the alkyl and aryl carbamates, aromatic ketones, hydrazide and phthalic derivatives are providing many intriguing physiological problems. In the case of carbamates, for example, we have mitotic poisons that appear to be strongly inhibitory of dehydrogenase enzymes, particularly of the succinoxidase system. It is difficult to say, however, whether these materials, in inhibiting succinoxidase, are thus effecting death of the cell, or whether the action is more complex.

In the study of the biochemical and physiological problems connected with the mode of action of biologically active materials it becomes necessary to consider not only the organism in toto, but the interrelationship of time to exposure. Thus, at any given point in the course of a treatment, it is not necessarily representative of the final picture. Thus, it becomes incumbent to study the progressive changes over a period of time.

"Determination of Maleic Hydrazide Residues in Plant and Animal Tissues." Paul R. Wood, Naugatuck Chemical Div., United States Rubber Co., Naugatuck, Conn.

A method is presented whereby maleic hydrazide (1,2-dihydropyridazine-3,6-dione), a plant growth regulant or retardant, is determined quantitively in various plant and animal tissues. The hydrazide is reduced and hydrolyzed to split off hydrazine, which is then distilled and determined colorimetrically. Residue determinations of below 1 p.p.m. are possible.

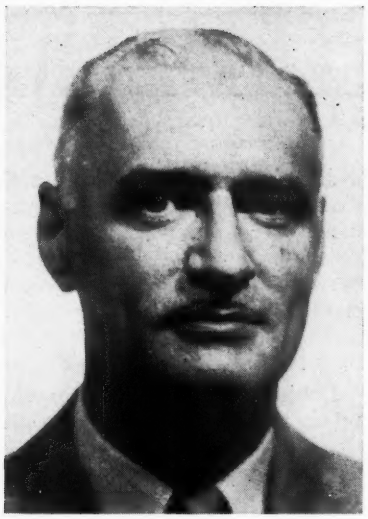
Maleic hydrazide is quite stable to both acidic and basic hydrolysis. However, after reduction, ring opening by alkaline hydrolysis readily occurs, yielding a quantitive amount of hydrazine which can be distilled out under favorable conditions. Many reduction-hydrolysis systems were evaluated, resulting in the present selection of zinc plus alkali in water.

Of the possible quantitive methods for determining micro amounts of hydrazine, a colorimetric method, based on azine formation with *p*-dimethylaminobenzaldehyde, was selected because minimum interference from naturally occurring substances resulted with this reagent. Water solutions of the intense red dye obey Beer's law and are stable after maximum color is developed in 10 to 15 minutes.

Some work has been done to extend this analytical method to other compounds. In general, the procedure can probably be used without major modifications for compounds which will form hydrazine under the conditions of this method. ◆

(Complete text of selected papers from this meeting will be presented in future issues of FARM CHEMICALS.)

A. B. Pettit
First General Chairman



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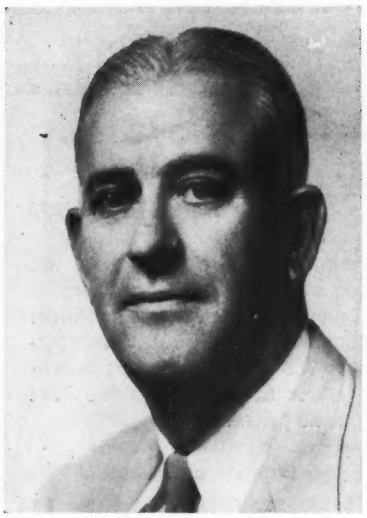

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Not interested in safety?

Fertilizer Group Plans Safety Meeting This Month

"THE fertilizer industry is not interested in safety and will not support a section."

That was the sentiment which greeted three fertilizer officials who years ago when they made preliminary plans to organize a fertilizer section of the National Safety Congress.

Obviously that attitude did not persist for today the section is one of the most active in the national organization. The men were convinced that if top management understood the objectives it would support the program.

Foresighted Men

Those foresighted men are J. S. Fields, Phillips Chemical Company; J. E. Smith, Spencer Chemical Company and A. B. Pettit, Davison Chemical Corporation. But even these men probably would have been surprised in 1950 if they could have seen the excellent program for the fertilizer safety section meeting to be held in Chicago Oct. 22–23 in the Sheraton Hotel.

Highlighting the program will be a demonstration of the multiple shot method of blasting stored fertilizer from 8:30 to 11:30 a.m. Oct. 23 at the International Minerals and Chemicals Corporation plant in Chicago Heights.

Safety and efficiency are key advantages of the multiple shot method, which was described in detail and illustrated in an article in the November, 1951 FARM CHEMICALS.

Fields will open the first day's meeting with a resume of activities of the section during the past year and plans for the future.

He will be followed by J. L. Rosenstein, of the University of Miami, who will address industry representatives from all parts of the country on the topic "Why Safety."

The multiple shot method will be discussed in a talk during the afternoon session by Mark Withey, of Trojan Powder Company. G. G. Blair, of Ebasco Services, Inc., will follow with a discussion of fire prevention in fertilizer plants through design to close the session.

The actual demonstration of the multiple shot technique will occupy the morning meeting Oct. 23. Election of officers is scheduled for the afternoon, with another discussion of multiple shot method with particular reference to points noted in the morning demonstration.

Plant Housekeeping

The important question of housekeeping in fertilizer plants will be aired by E. O. Burroughs, of F. S. Royster Guano Company. Other talks scheduled for the final meeting of the convention include Gas and Dust Control, by Herbert Walworth, Lumberman Mutual Casualty Company; How to Conduct a Safety Meeting, by T. J. Clarke. Grange League Federation and Fire Prevention in Fertilizer Plants Through Maintenance, the second talk by Blair. ◆

FERTILIZER MATERIALS MARKET

New York

September 10, 1952

Sulfate of Ammonia

Shipments of this material are being made against current orders but most people in the trade expect a shortage next spring. Some imported material was sold at Southern ports at prices equal to the domestic prices.

Nitrate of Soda

Stocks are available at various ports for prompt shipment and no shortage is expected over the next 30 days.

Ammonium Nitrate

There is an excellent demand for this material, particularly from the Midwest, for nearby shipment, and producers are still sold ahead with very little material reaching the market.

Organics

Organic fertilizer materials were firm in price but the demand from the feed trade has subsided somewhat. A considerable amount of imported cottonseed meal and linseed meal arrived at Atlantic ports to relieve the shortage and this material was sold at around $90 per ton, duty paid. Tankage and blood sold at $8.25 per unit of ammonia ($10.02 per unit N), f.o.b. Eastern shipping points. Fertilizer buyers are not paying these prices and most of the material is going to the feed trade.

Fish Meal

Domestic ground menhaden fish meal is selling at about $135 per ton, f.o.b. fish factories, with the fish scrap selling about $6 per ton cheaper. Imported fish meal is arriving in fairly large quantities and is selling at about $133 per ton, f.o.b. Atlantic ports for material guaranteed 60 per cent protein.

Bone Meal

Fertilizer steamed bone meal is very difficult to obtain but there seems to be a good supply of imported feeding bone meal which is available at various Atlantic and Gulf ports. Under the new Government regulations which were recently drafted in Washington, it is very doubtful if any raw bone meal can be imported into this country.

Nitrogenous Tankage

Domestic producers still are sold up for the balance of this year but some imported material recently has been offered at prices higher than the domestic market. Demand continues excellent in various directions.

Hoof Meal

Domestic material is selling at about $7 per unit of ammonia ($8.51 per unit N), f.o.b. cars Chicago, Ill. and demand has been good recently. Most of this material is going to industrial buyers.

Superphosphate

Recently the Government allowed manufacturers to increase their inventory of sulfur. For that reason superphosphate is in better supply and buyers are having no difficulty in securing this material for nearby shipment.

Potash

The producers of domestic muriate of potash are making regular shipments against contracts and unless a car shortage develops in the Southwest, buyers can expect to receive a normal supply of this material. Imported potash is being offered on a competitive basis at Atlantic and Gulf ports.

There is very little export demand for fertilizer materials, particularly from South America, as those countries have had considerable difficulty recently in securing the necessary American dollars to pay for the material.

Philadelphia

September 10, 1952

The general market is rather quiet. Sulfate of ammonia still is reported short in supply, while nitrate of soda stocks are quite ample. Blood and tankage are higher. Bone meal demand is slow, and superphosphate is no longer scarce, being rather abundant in some areas. Potash is in sufficient supply to meet all demands.

Sulfate of Ammonia.—The supply is reported still tight, but shipments of coke-oven grade are increasing. Fairly large purchases from abroad are reported, and quoted presently at about $56 per ton at the ports of entry, in bulk. Production of synthetic grade this year is well ahead of last year.

Nitrate of Soda.—Movement is along seasonal lines and stocks are well able to meet all requirements.

Blood, Tankage, Bone.—Blood has advanced to $8.25 per unit of ammonia ($10.02 per unit N), f.o.b. New York basis, and $8.50 ($10.33 per unit N), Chicago basis. Tankage also is higher at $9.50 ($11.55 per unit N), Chicago, but $8.25 to $8.50 ($10.02 to $10.33 per unit N), New York basis. Bone is quiet with the steamed grade priced at $75 per ton, and raw grade nominal at $70. Hoof meal offerings are rather limited at $7 per unit of ammonia ($8.51 per unit N), Chicago basis.

Castor Pomace.—Production is on a reduced basis and price is nominally $37.25 per ton at the works.

Fish Scrap.—Market is quiet with menhaden meal quoted at the ceiling of $135.60 in bulk, and scrap at $129.60 per ton. Importations have been much greater this year than last.

Phosphate Rock.—Market is reported quiet with domestic movement mostly against contracts. Stocks are ample.

Superphosphate.—Production has increased considerably and there is no longer any general scarcity. Price range remains 86 to 88 cents

per unit of available phosphoric acid per ton.

Potash.—Market is quiet with most activity centered on deliveries on contracts. Some new price adjustments are reported with 43 cents per unit as the present contract figure. Production abroad increased considerably.

Superphosphate.—Market conditions continue relatively unchanged and heavy demand for fall consumption is expected shortly. Stocks are relatively low and prices firm at ceiling levels.

Sulfate of Ammonia.—Supply conditions continue tight from domestic sources. No change in prices have been announced. Imported material is available for fall delivery at prices ranging from $54.25 to $56, f.o.b. cars at Atlantic ports. Supplies of this are limited.

Nitrate of Soda.—Consumption and sales of imported and domestic material are in seasonal dimensions. Stocks remain adequate. Imported material currently is priced at $57 per ton, bagged, f.o.b. cars at Atlantic ports.

Calcium Ammonium Nitrate.—Some of this material, testing 20 to 21 per cent nitrogen, of which approximately one-half is nitrate nitrogen and one-half ammoniacal nitrogen, is currently offered at $51.25 per ton bagged in 100 lb. paper or burlap bags f.o.b. cars at dock, Wilmington, N. C., Charleston, S. C. and Braithwaite, La., for fall and spring delivery. Heavy sales are being made as this form of nitrogen was favorably received during last season when it was imported in large quantities.

Charleston

September 10, 1952

Potash from imported and domestic sources currently is in adequate supply. Superphosphate continues relatively tight. Hard nitrogen, in some forms, particularly 33 per cent ammonium nitrate, is in short supply and demand strong.

Organics.—Interest in fertilizer grade organics is relatively light with domestic producers of nitrogenous tankage in a heavily sold position at prices ranging from $4.60 to $5 per unit of ammonia ($5.59 to $6.08 per unit N), bulk, f.o.b. production points. Offerings of imported material are also light at around $6 to $6.25 per unit of ammonia ($7.29 to $7.59 per unit N), in bags, c.i.f. Atlantic ports, for fall and spring shipment.

Castor Pomace.—Current production from domestic sources is being shipped against contracts at $37.25 per ton in burlap bags or $2 per ton less if shipment is in paper bags, f.o.b. Northeastern production points. The material is guaranteed minimum 6.75 per cent ammonia and limited supplies are available for the balance of this calendar year. Imported material has been sold recently at around $45 per ton, ex-vessel Atlantic ports.

Dried Blood.—The Chicago market on *unground* dried blood, in bulk, is around $8 to $8.25 per unit of ammonia ($9.72 to $10.02 per unit N) and the New York market is around $8.25 ($10.02 per unit N).

Potash.—Two producers at Carlsbad, N. M. have just recently announced that, effective Sept. 15 and 20, their price will be 43 cents per unit K_2O for 60 per cent grade muriate of potash, f.o.b. cars, bulk, Carlsbad, N. M. All other terms and conditions in 1952–53 price agreements remain unchanged. Movement is steady against contracts.

Ground Cotton Bur Ash.—This source of potash, primarily in the form of Carbonate of Potash, is available for prompt and spread shipment at prices approximating the delivered cost of domestic sulfate of potash. Analysis runs 38 to 45 per cent K_2O.

Phosphate Rock.—The market is rather quiet and no changes in prices have been noted. Stocks were somewhat tighter for the end of the week of Sept. 1.

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•
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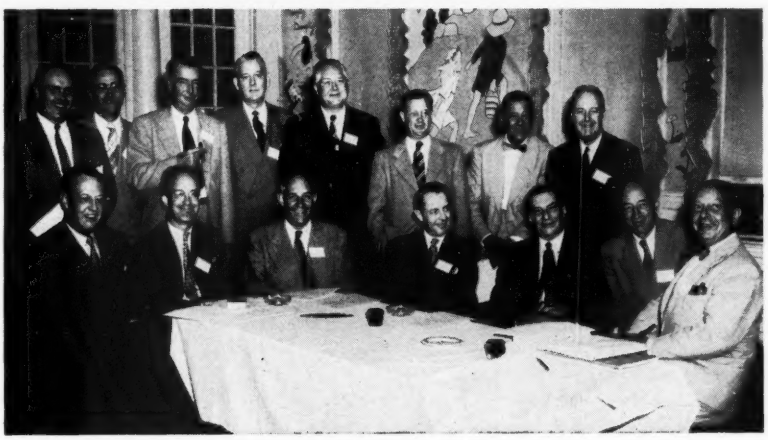
Industrial News

New Products **New Plants** **New Appointments**

NAC Officers and Directors



Pictured above are officers and directors of the National Agricultural Chemicals Association, elected at Spring Lake, N. J., meeting Sept. 3-5. Standing, from left, E. H. Phillips, James McConnon, Russell B. Stoddard, August Petrus, Ernest Hart, Paul Mayfield, vice president, Byron P. Webster and J. Hallam Boyd. Sitting, from left, F. W. Hatch, W. W. Allen, Arthur W. Mohr, president, John Paul Jones, W. C. Bennett, George F. Leonard and Lea S. Hitchner, executive secretary of NAC. *(Story, page 14.)*

DPA Approves Nine New Phosphate Units

Certificates of necessity issued by DPA from Aug. 28 through Sept. 3 included approval of nine new units for production of phosphatic fertilizer materials. Amount certified for the facilities totaled $17,616,925 with the two largest certificates going to Allied Chemical & Dye ($5,994,500) for construction of a nitraphosphate plant at South Point, O. and to Virginia-Carolina Chemical Corp. ($4,500,000) for a triple superphosphate plant at Nichols, Fla.

Other certificates included in the group were issued to Northern Chemical Industries ($1,395,000), nitraphosphate plant at Sandy Point, Me.; Smith-Douglass Co. ($439,000), phosphoric acid plant in Livingston County, Ill.; Phillips Chemical Co. ($3,086,050), triple superphosphate plant at Pasadena, Tex.; The Chemical Warehousing Co. ($245,000), normal superphosphate plant at Oklahoma City, Okla.; Mathieson Chemical Corp. ($1,811,292), ammonium phosphate plant at Pasadena, Tex.; Southwest Fertilizer and Chemical Co. ($290,683), normal superphosphate plant at El Paso, Tex. and The Best Fertilizers Co. ($451,000), ammonium phosphate plant at Lathrop, Cal.

Other recent DPA approvals include Union Carbide and Carbon Corp. ($476,000), ethyl acrylate and ammonium sulfate plant at Institute, W. Va.; Sullivan Mining Co. ($4,352,270), sulfuric acid unit in Shoshone county, Idaho and Kolker Chemical Works ($891,688), lindane facilities at Houston, Tex.

Smith-Douglass Moves To Buy Coronet Stock

Smith-Douglass Co., Norfolk, Va. is proceeding with an agreement to acquire a majority of outstanding Coronet Phosphate Co. stock. The company has offered to purchase shares held by remaining Coronet stockholders at the rate of $250 a share. At least 85 per cent of the stock must be deposited under terms of the offer.

Bankers Trust Co. was appointed agent to receive Coronet stock and F. Everstadt & Co. represented Smith-Douglass in the transaction. The offer expired Sept. 12.

NFA To Meet At Miami Beach

National Fertilizer Association's annual fall convention will be held at Miami Beach, Fla. Nov. 19–21. Reservations are being handled by the Roney Plaza Hotel, although heavy registration has made it necessary for NFA to make arrangements with the Surf Side and Traymore hotels to accommodate all those who desire to attend.

The NFA board of directors will meet on Nov. 19. The regular convention program, however, starts the next morning. A banquet will be held Nov. 21 to conclude the convention.

Speakers will include representatives from federal and state agricultural agencies, a representative from the American Bankers Association and a national political leader who will discuss matters relating to the industry and national economy.

Golfing and fishing will be featured in the afternoons.

New Davison Director

New director of technical service of the Davison Chemical Corp., Baltimore, Md. is Burton W. Graham. Graham joined Davison in 1944 after working for Activated Aluminum Co.

He has been succeeded as assistant general sales manager, Industrial Chemical Department, by D. P. Barrett, formerly in charge of Davison's New York sales office.

Farm Fertilizers Promotes

Three promotions have been announced by Farm Fertilizers, Inc., South Omaha, Neb. Leonard M. Brannan and Thomas J. Hoshall now are vice presidents of the organization and Arthur C. Jetter is treasurer and assistant secretary.

Brannan and Jetter have been connected with the company since its organization. Hoshall joined the staff two years ago.

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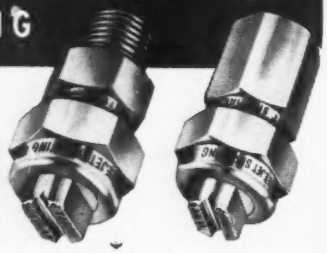

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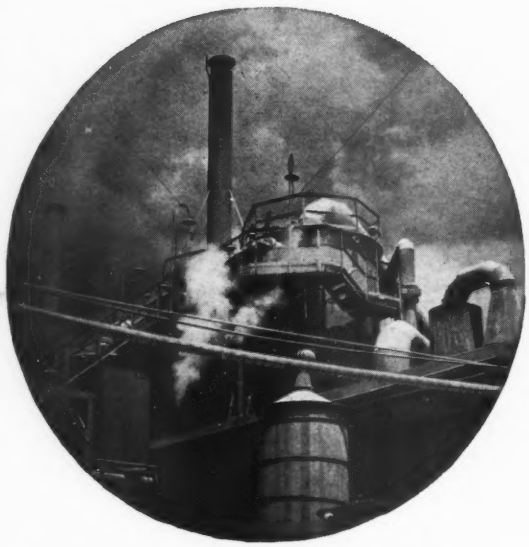

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Industrial News

Fertilizer Control Group Convenes in Washington

Washington's Shoreham Hotel was the site of the Association of American Control Officials' 60th Annual Convention Oct. 2 and 3.

Members of the association were banquet guests of the National Fertilizer Association in the Terrace Banquet Room the first day. A States Relations committee meeting followed.

Friday morning members heard addresses by President J. F. Fudge, Texas; Russell Coleman, NFA president; Paul T. Truitt, APFC president; Edwin Kapusta, NFA chemical engineer; Allen B. Lemmon, Chief, Cal. Bureau of Chemistry and H. J. Fisher, of Connecticut.

Truitt spoke on "Prospective Promotions for Plant Food," Kapusta's topic was "Some Manufacturing Problems and New Developments in Fertilizer Technology," Lemmon considered "Polyelectrolyte Soil Amendments" and Fisher gave the report of the States Relations committee.

During the afternoon Rodney C. Berry and M. B. Rowe, of Virginia, spoke to the officials on bulk fertilizer distribution. This was followed by reports of various investigators. Special committees on auditing, resolutions and nominating followed with reports.

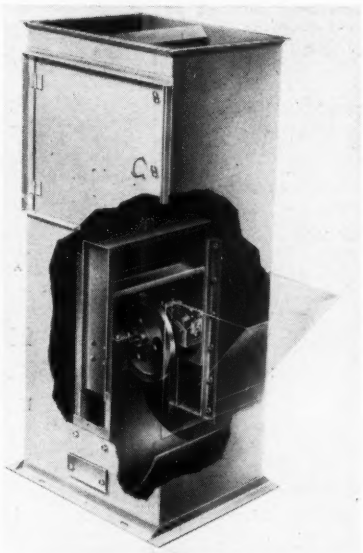
American Plant Food Council presented a banquet in honor of association members Friday evening in the Continental Room of the Wardman Park Hotel.

New Shell Fungicide

Shell Chemical Co's. Denver, Col., plant will begin producing commercially CBP-55, a new soil fungicide. CBP-55 has demonstrated outstanding effectiveness as a soil fungicide in control of soil pathogens in tobacco seed beds and for control of root-rots of strawberries and nursery stock.

The fungicide will be available for large scale spring treatments. Pilot plant stocks are adequate for fall supplies.

10-1 New Bucket Elevator Boot



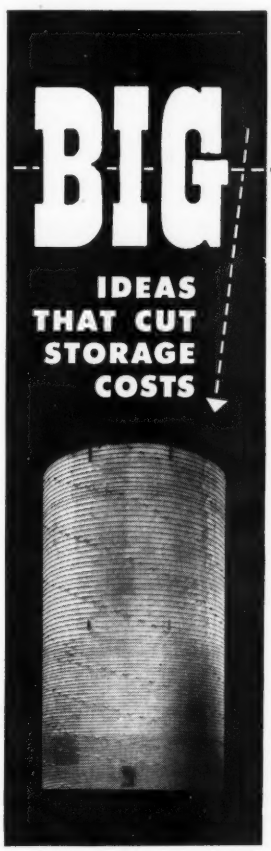
Beaumont-Birch Elevator Boot

Beaumont Birch Co. has introduced a new automatic take-up and water-tight bucket elevator boot which it says has long life and is maintenance-free.

Used for bulk handling of materials, the unit is designed to operate for years without adjustment, lubrication or maintenance other than removal of links from the elevator chain to compensate for wear, stretch or elongation, the manufacturer states.

Features of the bucket elevator boot include a full floating, self-adjusting automatic take-up mechanism which maintains proper chain tension, double sealed roller bearings held in dust-tight steel box packed with oiled waste and a gasketed water-tight clean-out door.

The company says screw type bucket elevator take-ups can be replaced with the Beaumont model. For further information, fill out a **Reader Service** card, using number **10-1.**



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Industrial News

All This and Fertilizer Too?

The Victor Fertilizer Co., Chester, S. C., took first place with this float in the sixth annual Chester County Guernsey Festival. R. A. Oliphant, president of the company, says that after seeing the fertilizer cotton bags made up into beach coats, every teen-ager in the country wants one with the printing on the back. Said Oliphant, "I doubt very seriously if there is a fertilizer manufacturer who ever expected to see anything so attractive in a cotton fertilizer bag."

Food Machinery Lists Six Personnel Changes

Several staff promotions were announced by the Food Machinery and Chemical Corp. board of directors at a recent meeting in San Jose, Cal. Included in the group stepping up to new positions are J. B. Cary, Ernest Hart, Benjamin C. Carter, Jackson V. Vernon, B. Earle Vosteen and Stuart H. Bear.

Cary, former executive vice president, was elected chairman of the executive committee and will share with the president, Paul L. Davies, responsibility for overall supervision of corporation activities.

New executive vice president is Ernest Hart, formerly president of the Niagara Chemical Division. He will be responsible for operation of the corporation's chemical divisions with headquarters in the Chrysler Building East, New York City. Carter also was made an executive vice president in charge of the mechanical divisions with headquarters in San Jose.

Jackson C. Vernon succeeds Hart as president of the Niagara Chemical Division. Vernon has been with the Niagara unit since 1923 and formerly was assistant sales manager.

Vosteen is vice president and controller of Niagara Chemical and assistant secretary of the corporation. Bear was named vice president and sales manager of the Niagara Division. He formerly was assistant sales manager of the division.

Fertilizer Manufacturers May Adjust Ceiling Prices

Fertilizer mixers with ceiling prices established under Ceiling Price Regulation 22 or the General Ceiling Price Regulation now are permitted to adjust their ceilings so that increases in inbound freight costs of raw materials and outbound costs resulting from delivery of mixed goods to purchasers, are reflected.

The adjustments, however, can be made only for increases resulting from freight rate boosts which have occurred since April 1, 1951. Mixers under CPR 22 who already have adjusted prices through Sup. Reg. 17 or 18 of CPR 22 or General Overriding Regulation 20 can provide for increases only on freight rates which have been upped since July 26, 1951.

Those under GCPR who have adjusted prices according to General Overriding Regulation 20 or 21 are limited in increases based on freight rates since the same date.

Raw materials considered in the inbound freight adjustment include only nitrogenous material, superphosphate, potash materials and filler materials. The adjustment must be calculated separately for each plant.

Adjustments based on outbound freight rates can be made if mixed goods are sold on a delivered or freight equalized basis. A separate determination must be made for each marketing area in which a uniform delivered price is customarily quoted.

Sales of Insecticides To Mexico Show Drop

Mexican purchases of insecticides in 1952 have dropped considerably below 1951 sales to that country. In the first six months of the year 10,449 tons of insecticide materials valued at $4,421,580 were purchased. During the same period of 1951 17,517 tons worth $5,566,880 were bought.

In all but February, declared values of the materials also were lower than last year. In February, despite a drop in tonnage, declared value registered a $219,920 increase.

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Industrial News

Many Personnel Changes Made in Nitrogen Division

The September issue of "Nitrogen Division Life," company publication of the Nitrogen Division, Allied Chem. & Dye, reports several personnel changes in the division.

Frank C. Weaver has been made Hopewell plant accountant following transfer of E. F. Fiedler to the New York office as auditor of the division. J. C. Redding has replaced Weaver as account (chief) at Hopewell.

A newly created post of personnel manager at the South Point, O. plant has been filled by Ira H. Lane who has been with the company since 1934. Since his transfer to South Point in 1945 he has served as assistant superintendent of the ammonium nitrate section and, prior to his recent appointment, was assistant superintendent of the ammonium nitrate and urea sections.

Two field sales posts were filled when Emerson M. Jones Jr. was named field representative for fertilizer materials in Indiana, Illinois, Missouri and western Kentucky, succeeding J. C. Docter who now is field representative for direct application materials in the same area.

Theodore E. Detcher has been named assistant sales manager for industrial nitrogen chemicals with headquarters in the division's New York office.

Formerly section supervisor for direct application materials, Walter A. Fornoff has been named assistant to the assistant director of sales at the New York office. He has been succeeded by George A. Kalteisen Jr.

Potash Unit to Open

Loading bins at the Carlsbad, N. M. plant of Southwest Potash Corp. are scheduled to begin operation this autumn. A subsidiary of American Metals Corp., the new company plans to produce approximately 210,000 tons of K_2O per year. Major facilities have been designed to enable rapid expansion to better than twice the initial capacity.

Joins Summers

K. D. Morrison

Former president of Naco Fertilizer Co., Charleston, S. C., K. D. Morrison has joined Summers Fertilizer Co., Baltimore, Md. as vice president in charge of sales.

Mr. Morrison previously was in charge of eastern sales distribution of both foreign and domestic potash producers. Prior to joining Naco he was vice president of the Davison Chemical Corp., Baltimore, Md.

Stauffer, Two Others Erecting Phosphate Unit

Stauffer Chemical Co. has reached an agreement with American Smelting & Refining Co. and Kennecott Copper Corp. for the erection and operation of a concentrated phosphate fertilizer plant near Salt Lake City. Phosphoric acid also will be produced by the wet process.

Phosphate rock will come from Stauffer's deposits in Wyoming and Idaho and sulfuric acid from Garfield Chemical Co's. Salt Lake City plant. Additional acid will come from smelter gases and will not require scarce sulfur. Recovery of uranium and vanadium is contemplated.

Construction will begin late this year. The 60,000 tons-per-year plant will start operation during the summer of 1953.

Located near its source of raw materials, the plant also will have a wide market area, extending from the Pacific Coast to the Midwest.

The joint company, as yet unnamed, will be capitalized at between four and five million dollars. Approximately 600 acres have been reserved for the operation.

USDA Scientists Modify 2,4-D for Beneficial Use

USDA scientists in controlled greenhouse experiments have modified 2,4-D in such a way that the material is beneficial to tomato plants. Without harming the plant, modified 2,4-D caused fruit to set and developed tomatoes of increased size and excellent quality without pollination.

When used as a weed killer the destructive power of 2,4-D is contained in the carboxyl group. To tie up this group so that its lethal power was controlled, 2,4-D acid was combined chemically with certain amino acids, resulting in an amide linkage. Although some plants can split this link enzymatically, and are affected by the carboxyl group, others are unable to do so and may be aided by the modified weed killer.

Field tests now are in progress on 2,4-D amino acid compounds. Additional amino acids are being synthesized and combined with the weed killer for tests in which the researchers hope to learn more about the relationships of plant-growth regulating chemicals and plant enzyme systems.

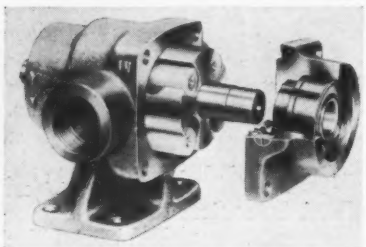
Warning for 2,4-D

Serious injury to grape vines may result from use of 2,4-D, in any of its forms, according to Dr. Nelson I. Shaulis, horticulturalist at the Geneva, N. Y. Experiment Station.

The spray may kill grape vines outright or may delay maturity and seriously deform shoots and leaves. Use of 2,4-D in a sprayer which might be used later to spray grapes also may give trouble. The chemical also can drift into a vineyard from nearby areas with disastrous results.

Industrial News

10-2 New Hypro Industrial Pump



Hypro Industrial Pump

Special design features are embodied in a new industrial pump manufactured by Hypro Engineering, Inc. The pump has a scoop rotor and roller-type vanes. Design originally was developed in the company's tractor power take-off pump for weed and insect spraying, which has been highly efficient for three seasons in handling erosive wettable powder solutions.

The pump is especially adapted for use where lime, talc and similar abrasives are used.

It is called the Hypro 4000 Series and is engineered to withstand continuous heavy radial loads by the use of sealed lubricated ball bearings. A pressed fit of the stainless steel shaft into the inner race of the ball bearings restricts lateral movement of the rotor, minimizing end thrust and wear of the rotor within the pump.

A bulletin gives a complete description of the pump, including specifications and price.

For further information, fill out a **Reader Service** card, using number **10-2.**

Monsanto Will License Production of Conditioners

Formulators will be licensed for production of soil conditioners under patents held by Monsanto Chemical according to a program recently announced by the company. Monsanto will provide, as part of the program, technical information including application information concerning each conditioner used.

A modified vinyl acetate maleic acid compound will be the first product sold through the licensing arrangement. John Gillis, Monsanto vice president said the material has been proved in extensive tests by the company and hundreds of cooperators to be the most effective soil conditioner for horticultural and agricultural use.

Formulators will use their own brand names on the labels and will be free to list chemical composition of the product. The fact that they are licensed under Monsanto patents also will be noted.

This marks the first step by Monsanto for sale of these materials to formulators. The company's merchandising division will continue to expand sales of Krilium on a nationwide basis.

Urges Attendance

T. L. Clarke, personnel director of G. L. F. Soil Building Service, Ithaca, N. Y., news editor of Safety News Letter, distributed by National Safety Council to all fertilizer plants in the United States, urges fertilizer management to have representation at the National Safety Congress in Chicago, Oct. 22–23. Two afternoon sessions will be devoted exclusively to talks and demonstrations on fertilizer accidents and control.

McVickar Writes Fertilizer Book

NFA's chief agronomist, Malcolm H. McVickar, is author of a new book, "Using Commercial Fertilizer." Covering fertilizer terminology, manufacture and use it is particularly adapted for vocational agriculture classes as well as on-the-job training of veterans.

Throughout the book McVickar has chosen every day terms to describe technical processes and has made no attempt to cover chemical theory. His easy to read style and more than 100 photographs and charts are aimed at providing the reader with a much better understanding of fertilizers and their use.

"Using Commercial Fertilizer" is an excellent book for the fertilizer salesman interested in learning the how and why of his business without getting involved in technical terms and processes. It's available at a trade price of $3 from The Interstate, Danville, Ill.

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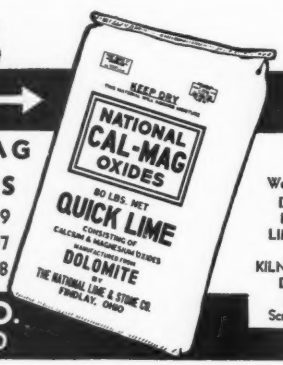

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Industrial News

NFA's Plant Food Meter Very Popular in Industry

The Plant Food Meter recently introduced by the National Fertilizer Association already has received wide acceptance with many thousands already ordered. The original order date of August 30 was extended so that more orders could be filled, according to the association.

A slide rule gadget, the meter provides quick calculation of the removal of major plant food by various crops and also permits the user to determine the quantities of plant food furnished by major fertilizer grades and materials. At a small additional price, members have had their company names printed on the plastic cover.

NFA also has a 40-page booklet, "At Your Service," available. Activities of the association, its certificate of incorporation and by-laws, a list of members and information on how to join the association are included in the attractive bulletin.

It has been published to keep members informed on the NFA program and also to explain the advantages to membership for those eligible to join the group.

USDA Drafting Rules For Imported Bone Meal

Imported bone meal, tankage and other animal by-products soon will be subject to amended regulations now being drafted by USDA. Purpose is a minimization of the danger of anthrax and other animal diseases being brought into the country.

Tightening up of bone meal imports results from a midwest anthrax scare last May and June. Source of the trouble was traced to a European bone meal shipment. The disease spread rapidly through the midwest but has now subsided to a considerable extent. USDA officials do not promise that it won't reoccur next year in a new area because of lax supervision of sources where the disease may be distributed, especially rendering plants.

Amended regulations permit importation of only steamed and degelatinized bone meal which in the manufacturing process has been subjected to a minimum of 20 pounds steam pressure for at least an hour at a temperature of not less than 250 degrees Fahrenheit.

Imported bone, including crushed bones, horns and hoofs for use as fertilizer or animal feed would have to be consigned directly to approved concerns for further processing. USDA will judge fitness of equipment and facilities for proper handling of the materials.

Dried blood, blood meal, animal organs, tankage, meat meal, wool waste and similar imports for use in fertilizers or animal feeds would be prohibited unless originating in or shipped directly from countries free from foot and mouth disease or rinderpest or accompanied by a certificate of a consular officer showing that the products were heated throughout to a temperature of not less than 156 degrees Fahrenheit.

New Fungicide Stimulates Root Growth, Tests Indicate

Dr. Michael Szkolnik has been conducting experiments with a new fungicide which shows stimulating effects used as a root-dip for transplants at New York State's Experiment Station at Geneva.

First observed in disease control studies with the quinine tree, the two chemicals, Orthocide and Dithane Z-78, now are used on tomato plants.

It is believed that an intermediate product occurs as a by-product as a breakdown of these chemicals.

These products apparently induce development of a greater root mass which in turn stimulates greater top growth.

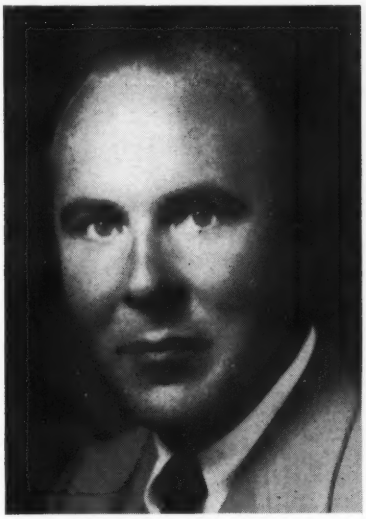
Columbia-Southern Changes

Recent appointments announced by Columbia-Southern Chemical Corp. include assignment of Eugene D. Witman as manager of agricultural chemical development, Edwin D. Plant as manager of agricultural chemical sales and Forrest W. Buck Jr. as sales representative in the New York area.

Gidney Appointed

United States Potash Co. has announced appointment of Dean R. Gidney as vice president in charge of sales.

Gidney has been in the company's sales departments ince 1938,



Dean R. Gidney

except for a period during World War II, when he served in the U.S. Navy. A member Phi Beta Kappa, Gidney was graduated from Dartmouth College in 1936. Before joining U. S. Potash, he was employed by United States Trust Co.

Gidney was advanced to Sales Manager in 1950. As vice president, he succeeds J. E. Barnes, who retired recently.

Two Potash Records Set

Potash deliveries during the second quarter and the first half of 1952 set new records. During the first half of the year total deliveries in North America, including imports, were 1,560,935 tons of potash salts containing an equivalent of 895,865 tons of K_2O. This was an increase of five per cent in salts and six per cent in K_2O over the same 1951 period.

A second quarter record of 896,364 tons of salts was set. This represented an equivalent of 518,022 tons K_2O and was an increase over the 1951 period.

Industrial News

Armyworm outbreak . . .

United States Pest Survey

NUMEROUS outbreaks of **armyworms** were reported from various states for the 1952 growing season some very severe in nature. Southern Wis. counties suffered the worst outbreak in 10 years in mid-July as the worms caused heavy losses of corn and grains. This infestation also extended into northern Ill. and southern Minn. where cereal and forage crops were considerably damaged.

Earlier in the year, during May, a severe outbreak occurred in an area covering northwestern Tenn., western Ky., southern Ill. and southeastern Mo. Small grains and grasses were badly damaged in Tenn. and Ill. and lighter, but serious, injury occurred in Ky. and Mo.

Infestations were reported from Me. to S. C. along the Atlantic Coast. Although these were not reported as severe or widespread, small grains and grasses were considerably damaged in N. J. Vermont is reported as having suffered the first outbreak since 1938.

Heavy outbreaks, local in nature were also recorded in Mich. and O. Other states from which reports of armyworm activity have been received include: R. I., N. Y., Del., Md., N. C., Ala., Miss., La., Okla. and Iowa.

Fall armyworms have been reported active in a number of southeastern states including Ala., Tenn., La., Ga. and Fla. In southeastern Ala. there are considerable infestations on peanuts although these are not as widespread as the corn earworm. In combination with the corn earworm it is attacking grain sorghum, sudan grass and related crops.

Damaging populations were beginning to appear in La. during late August and spotted infestations were noted in some Gadsden Co., Fla., pastures.

Very numerous in some southern areas of Ga. with heavy infestations on peanuts and grass in Dooly Co. They continue to spread in eastern areas of Tenn. damaging young corn, alfalfa and pastures.

A summary of the **Say stinkbug** shows that very severe outbreaks occurred this year in Utah, Colo., Wyo. and Ida. Utah reports that the infestation in that state was the most general in 27 years. In Millard Co. alone losses are estimated at $100,000 and reductions of 15 to 25 per cent in seed alfalfa yields were common in some areas.

Sugar beets, other small grains and pastures were also damaged in Utah and severe infestations on barley, wheat and alfalfa were reported in Delta and Garfield counties, Colo. Severe damage to wheat occurred in the eastern area.

Damaging outbreaks in southeastern Wyo. winter wheat were found with populations especially high in the Douglas area. Infestations in southcentral Ida. moved from sagebrush to barley and wheat.

Other infected areas included the Prosser area of Wash. where the bug was reported unusually abundant on alfalfa, light infestations in the San Joaquin Valley, Cal. and the Salt River Valley, Ariz. where sugar beets were affected and in the cotton growing areas of Ariz. and N. M.

Presence of many important pests have been noted throughout the country. Here are brief notes on a few of these based on reports compiled through late August.

CEREAL AND FORAGE INSECTS

Much of Okla. range land in Cimmaron Co. is reported as carrying range **grasshopper** populations in economic numbers. In Utah about 2,000 acres of re-seeded crested wheat grass land were destroyed and about 80 per cent of heads were clipped off through activity on 20,000 acres of older seeded range land.

Damage to canning tomatoes in Ind. has been serious in some areas and surveys in Wis. show buildups in both eastern and western counties.

The **Two-spotted Spider Mite**

FEEDING AND FERTILIZER MATERIALS

(SINCE 1898)

SAMUEL D. KEIM

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Industrial News

has severely damaged corn in Neb. where some entire fields have been destroyed near North Platte. The infestation covers a 230 mile stretch. Corn also is being seriously damaged in the Arkansas valley, Colo.

FRUIT INSECTS

Spider Mites have been active in orchards in many parts of the country. Injury to Ind. orchards range from light to severe with Red Delicious showing the most severe injury. Defoliation occurred in some orchards where the pests were not checked promptly.

The Two-spotted mite has built up rapidly in at least one N. Y. county and many orchards in that area have suffered severe injury. This mite also is increasing in Mass. and is considered potentially serious in most orchards.

Stink Bugs caused considerable injury to peaches in the Vincennes area of Ind. with from two to 18 per cent catfacing in orchards.

TRUCK CROP INSECTS

A new type of mite infestation has been found on tomatoes in two Salem Co. fields. They appear to be the **Rust mite**, although identification is not yet complete. Feeding results in a severe, brown, sooty-like russeting of stems and leaves and in many instances only the terminal bud remains green.

This is reported as the first N. J. observation of such mites and entomologists have suggested that spraying with sulfur at 7.5 pounds per acre be used as a control measure.

In Va. the **corn earworm** has severely damaged lima beans, pepper, eggplant, kale, collards and broccoli. In eastern areas of that state the infestation is the heaviest in many years. Also reported on beans in Del. and Tenn.

COTTON INSECTS

Cotton **Boll weevils** were reported on the increase in S. C. with evidence of migration in most counties. Average infestations reported as 46 per cent in treated fields and 85 per cent in those not treated.

They have also increased rapidly in Tenn. with local migrations taking place. A large adult population and high rate of infestation indicate a large number of hibernating weevils this year in Ala. Some fields of young cotton in Ark. reported as infested for first time this season.

In western Tenn. the **Cotton bollworm** has been reported more prevalent and damaging than at any time this season. Light scattered infestations found in areas of N. M. and the worms continue to be major pests in some Ariz. counties.

Reported on the increase throughout S. C. and there are some indications of heavier infestations in Ala. **Bollworms** continue heavy in northwest La. and, although the larvae are decreasing in Okla. fields, an increase in eggs has been noted.

No serious infestations of the **Cotton leafworm** have been reported in Ala. but they are building up rapidly in the Deming area of N. M. and scattered infestations in the Mesilla valley of that state have been noted.

OPS Considers Sales To Farmers as Retail

Sales of fertilizer to farmers are considered retail sales instead of wholesale sales under a new Office of Price Stabilization ruling.

The change may cause a rise in ceiling prices. OPS officials cautioned that sellers who gave special prices to farmers during the base period, or to different classes of farmers, must continue to do so. The amendment does not change OPS rules which require price differences to different classes of purchasers.

A retailer's ceiling price for sales of a particular fertilizer to farmers is determined by the highest price at which he delivered it during the base period (Dec. 19, 1950 through Jan. 25, 1951) to a purchaser of the same class.

Also, not now applicable to sales of fertilizers to ultimate users are rules which in some cases permit the use of price list prices instead of actual delivered prices during the base period.

DDT in Soil Kills Japanese Bettle Grubs for Five Years

Research by U. S. Department of Agriculture shows that a single application of DDT to the soil will kill Japanese bettle grubs living there for at least five years.

Tests conducted in locations ranging from Massachusetts to New Jersey by the Bureau of Entomology and Plant Quarantine showed an average DDT carryover in turf of 92 per cent after two years, 43 per cent after four years, 36 per cent after six years and 29 per cent after seven years.

The rate of application appeared to have little influence on the per cent of toxic residue. Soil samples were treated at the rate of both 25 and 50 pounds of DDT per acre, but the percentage carry-over in eight years of testing was about the same in either case.

Tests conducted at the Bureau's Moorestown, N. J. laboratory with different types of soil proved that DDT lasts longer in poor soils; a shorter time in soils high in organic matter. Results of experiments with samples of 85 different soil types gathered from seven eastern states showed that DDT persistence in sandy, silt or clay loam was about the same, but much greater in soils made up primarily of sand.

Laboratory tests involving more than 223,000 Japanese beetle grubs showed DDT beginning to lose its killing power only in the fifth year after application. A single treatment at the 25-pound per acre rate resulted in 95 per cent grub kills within four weeks after the grubs were put into the soil, during the first four years. It required slightly more than five weeks to get the same kill the fifth year.

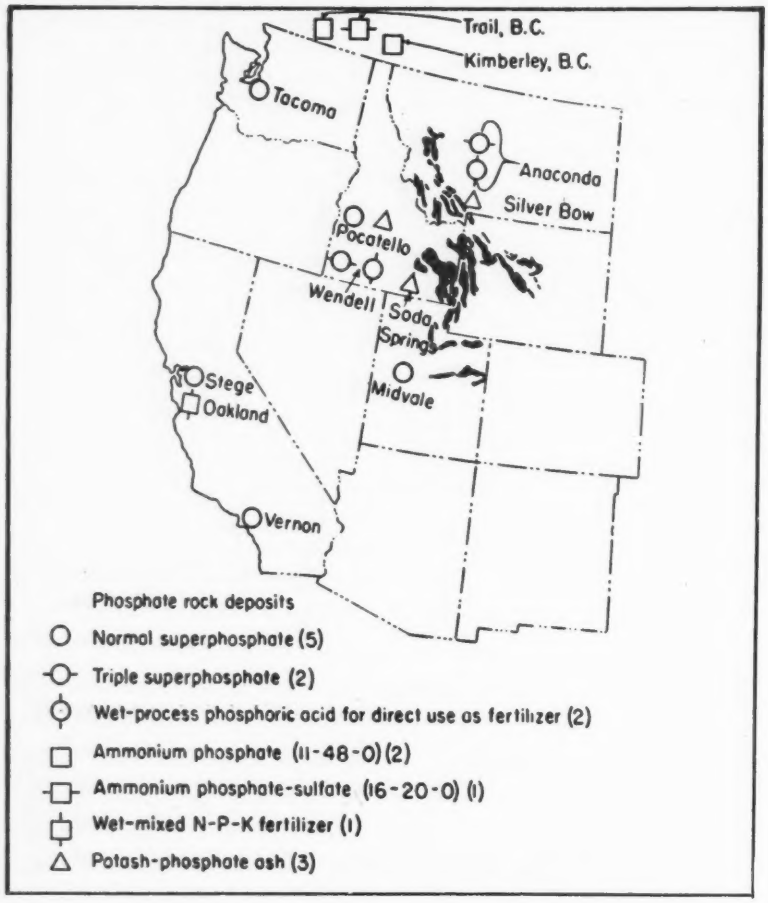
Daily, Lewis, Join Hough

Daniel Daily and Richard Lewis are new district representatives for Frank G. Hough Co. Daily, whose office is in Minneapolis, will cover North and South Dakota, Minnesota, Iowa, Wisconsin and upper Michigan. Lewis will cover Western Missouri, Wyoming, Nebraska, Kansas and Colorado from his office in Kansas City, Mo.

...Phosphate Fertilizers for Western Agriculture

(*Continued from page 29*)

Figure 6. Phosphate-rock Deposits and Processing Facilities in the West.



potash-phosphate ash also are obtained as a byproduct of the manufacture of elemental phosphorus by the electric furnace process. The distribution of these facilities, as of June 1, 1952, is indicated in Figure 6, which also shows the approximate locations of the principal deposits of phosphate rock in the Western States.

Not indicated in Figure 6 are two plants, one each in California and Washington, that manufactured phosphate rock—magnesium silicate glass in certain years of the period 1945 to 1950, by fusing phosphate rock with serpentine or olivine in electric furnaces. Both plants have ceased production of the material, at least for the present. Also omitted is a plant for production of Rhenania-type phosphate by sintering phosphate rock with soda ash, which is reported to be nearing operation in the Rocky Mountain region. The latter material is of special interest, since it appears to be an exception to the general rule that citrate-soluble phosphates are less effective than the water-soluble materials in promoting growth of crops on alkaline soils. Defluorinated phosphate rock, nitric acid—phosphate rock products and calcium metaphosphate are not manufactured in the West, but the last is said to be included in plans for future production in the area.

The three phosphorus plants, of which two (Pocatello, Idaho and Silver Bow, Mont.) are in operation and the third (Soda Springs, Idaho) is nearing completion, produce byproduct potash-phosphate ash for fertilizer, but their output of elemental phosphorus is used entirely, or nearly so, for non-fertilizer purposes. With the exception of potash-phosphate ash, all of the facilities indicated in Figure 6 produce phosphate fertilizers by processes that involve the use of sulfuric acid. The acid is made chiefly from smelter fumes and gases and pyrites concentrates.

It will be noted that the facilities include ammonium phosphate and ammonium phosphate-sulfate

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plants at Trail, British Columbia and an ammonium phosphate plant (under construction) at Kimberley, British Columbia. These plants supply considerable quantities of phosphate fertilizers to the United States, mostly to the Mountain and Pacific States.

Production of liquid phosphoric acid for direct use as fertilizer—by application in irrigation water and by injection into the soil—is confined to two plants, one each in Idaho and Montana, that make the acid in conjunction with manufacture of triple superphosphate.

Capacity for Production of Fertilizer Materials

As of June 1, 1952, the estimated annual capacity of the 16 facilities for production of chemically processed phosphate fertilizers in the Western States and British Columbia, indicated in Figure 6, totaled 279,740 short tons of available P_2O_5. The estimate is based in part on the data of a survey in 1951 of the superphosphate and wet-process phosphoric acid industries in the United States (*1*). Of the indicated capacity, 102,040 tons (36.5 per cent) is in the form of normal superphosphate. The figures include expansions in the capacity of one normal superp' osphate plant and in one elemental phosphorus plant that produces potash-phosphate ash as a by-product. Also included are estimates of the capacities for ammonium phosphate (11–48–0) in the new plant under construction at Kimberley, British Columbia, and for potash-phosphate ash in the new elemental phosphorus plant being built at Soda Springs, Idaho.

Additional facilities, reported as projected or under construction but not included in the estimate, comprise three wet-process triple superphosphate plants, two electric furnace plants for triple superphosphate and (or) calcium metaphosphate, and one plant for Rhenania-type phosphate. The planned total capacity of these facilities is said to exceed 125,000 tons of P_2O_5 annually.

The Nation's capacity for production of potash fertilizers is located almost entirely in the West. The western facilities, which supply potash mostly in the form of potassium chloride and have a total annual capacity of some 1,700,000 short tons of K_2O, comprise two plants (one each in California and Utah) that produce potash from lake brines and five plants in New Mexico that produce it from water-soluble minerals.

Facilities for production of nitrogen materials in the Western States include six synthetic ammonia plants (four in California and two in Washington) with an estimated total capacity of about 185,000 short tons of nitrogen per year. These plants comprise four that are now in operation and two new plants (one each in California and Washington) that have been issued certificates of necessity for accelerated tax amortization under the current program of expansion in production of fixed-nitrogen materials. Byproduct ammonia from coke ovens is produced at several points in the Mountain and Pacific States. Considerable nitrogen is also supplied to western agriculture by the synthetic ammonia plants at Trail, British Columbia and Calgary, Alberta.

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Federal Chemical

(*Continued from page 37*)

ties; in the thirties Federal increased production with acquisition of Floyd Plant Food Company, East St. Louis, Ill., West Tennessee Fertilizer Company, Humbolt, Tenn. and plants of the Meriden Fertilizer Works.

It was during this expansion that the company faced big personnel losses with the deaths of three of its leading men: Crady, Arthur Key and old "Cap" Astroth.

Recent purchases by the company include the Longaker Mills plant, Butler, Ind., in 1949 and a site in Danville, Ill. this year for erection of another new plant.

Modernization programs, conducted continuously at Federal, include a batching system employing unit-hopper, automatic machines.

John V. Collis, now head of Federal, is only the fourth man to head the 68-year-old company.

And with all its changes, throughout Federal's long and interesting history in the fertilizer industry, one thing has remained conspicuously unchanged. That's the company's slogan—"The World's Best Fertilizer." ◆

Industrial News

International's 100,000th Carload

The 100,000th carload of potash to come from International Minerals & Chemicals mines at Carlsbad, N. M., is opened at N. S. Koos and Son Co., fertilizer company, Kenosha, Wis.

Second Agronomy Book Out

"Soil Physical Conditions and Plant Growth" is volume two of Agronomy, a series of monographs prepared under the auspices of the American Society of Agronomy.

Edited by Byron T. Shaw, it is the first comprehensive book covering the relationship between physical condition of soils and plant growth. Contents cover such topics as the influence on plant growth of soil moisture, soil aeration, soil temperature and mechanical impedance to development of roots and shoots.

It is written by a group of scientists including L. T. Alexander, BPI, J. F. Lutz, N. C. State College, S. J. Richards, Univ. of Cal. and others. Available from Academic Press Inc., Publishers, 125 E. 23rd St., New York 10, N. Y.; 508 pages, illustrated; $8.80 a copy.

NFA Reports Fertilizer Sales Heading for Record

Fertilizer sales in the fiscal year 1951–52 appear to be headed for a record high, according to National Fertilizer Association. Based on tax tag sales and reports of fertilizer shipments from 10 southern and three midwestern states, this estimate is well justified.

In the first 11 months of this fiscal year, 10.6 million tons of fertilizer were sold in these states. This is an increase of a half-million tons estimated sold during the same period last year.

Because sales in these states traditionally represent more than half the fertilizer sold in this country, a new nationwide fertilizer consumption record probably will be registered when the final count is made.

Leafhopper Causes Big Reduction in Alfalfa Crop

A drastic cut in the alfalfa crop of such states as Minnesota, Wisconsin, Illinois, Indiana, Michigan, New York, Pennsylvania, Maryland and Delaware has been caused by the potato leafhopper. These were the states toward which stockmen in drought areas were looking for hay supplies.

Leafhoppers are an annual threat to the nation's hay crops. This year, ideal weather conditions to favor their activities combined with one of the heaviest leafhopper populations ever observed.

Conservative estimates in several north central hay growing areas set the loss due to these insects at about 50 per cent of the anticipated second and final cutting of alfalfa. Leafhoppers have destroyed enough hay to have fed cattle in drought areas through the winter.

This year, however, experimental work has uncovered the first usable program for controlling leafhoppers with insecticides. One of these is a methoxychlor emulsion, used because it presents no toxic hazards either to livestock or humans.

POTASH

Call or wire

ALEXANDER M. McIVER & SON

P. O. BOX 155 Charleston, S. C.

Phones: L. D. 921 and 922

Buyers' Guide

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AGRICULTURAL CONSULTANTS
Bailey & Lerch, Washington, D. C.

ALDRIN
Ashcraft-Wilkinson Co., Atlanta, Ga.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.

AMMONIA—Anhydrous and Liquor
Commercial Solvents Corp., New York City
Lion Oil Co., El Dorado, Ark.
Mathieson Chem. Corp., Baltimore, Md.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM NITRATE
American Cyanamid Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
Lion Oil Co., El Dorado, Ark.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM PHOSPHATE
American Cyanamid Co., New York City
Monsanto Chem. Co., St. Louis, Mo.

AMMONIUM SULFATE
See Sulfate of Ammonia

BAGS—Burlap
Bemis Bros. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Multiwall-Paper
Bemis Bro. Bag Co., St. Louis, Mo.
International Paper Co., Bagpak Div., N. Y. C.
Hammond Bag & Paper Co., Wellsburg, W. Va.
Hudson Pulp & Paper Corp., N. Y. C.
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Kraft Bag Corporation, New York City
Mente & Co., Inc., New Orleans, La.
Raymond Bag Co., Middletown, Ohio
Union Bag & Paper Corp., New York City
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.

BAG CLOSING MACHINES
Fischbein Co., Dave, Minneapolis, Minn.
International Paper Co., Bagpak Div., N. Y. C.

BAG CLOSING—THREAD & TWINE
Bemis Bros. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.

BAG PRINTING MACHINES
Schmutz Mfg., Louisville, Ky.

BAG FILLING MACHINES
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

BHC AND LINDANE
Ashcraft-Wilkinson Co., Atlanta, Ga..
Commercial Solvents Corp., New York City
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Tennessee Products & Chem. Corp., Nashville, Tenn.

BONE PRODUCTS
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
McIver & Son, Alex M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BORAX AND BORIC ACID
American Potash and Chem. Corp., N. Y. C.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
Keim, Samuel D., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BUCKETS—Hoist, Crane, etc.
Hayward Company, The, New York City

CALCIUM ARSENATE
American Agricultural Chemical Co., N. Y. C.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.

CARS AND CART
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

CASTOR POMACE
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.

CHEMISTS AND ASSAYERS
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CHLORDANE
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CONDITIONERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
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Sackett & Sons Co., The A. J., Baltimore, Md.

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Tennessee Corp., Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa

CYANAMID
American Cyanamid Co., New York City

DDT
Ashcraft-Wilkinson Co., Atlanta, Ga.
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Monsanto Chemical Co., St. Louis, Mo.

DIELDRIN
Ashcraft-Wilkinson Co., Atlanta, Ga.

DILAN
Commercial Solvents Corp., New York City

DILUENTS
Ashcraft-Wilkinson Co., Atlanta, Ga.

DITHIOCARBAMATES
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.

DRYERS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS—Bucket
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City
Fairlie, Inc., Andrew M., New York City
General Industrial Development Corp., N. Y. C.
Marietta Concrete Corporation, Marietta, Ohio
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.
Titlestad Corporation, Nicolay, New York City

FERTILIZER—Mixed
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Min. & Chem. Corp., Chicago, Ill.
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Virginia-Carolina Chemical Corp., Richmond, Va.

FILLERS
McIver & Son, Alex. M., Charleston, S. C.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston. S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

FULLER'S EARTH
Ashcraft-Wilkinson Co., Atlanta, Ga.

FUNGICIDES
American Agricultural Chemical Co., N. Y. C.
Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Tennessee Corp., Atlanta, Ga.

HERBICIDES
Lion Oil Company, El Dorado, Ark.
Monsanto Chemical Co., St. Louis, Mo.

HERBICIDES—Oils
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Lion Oil Company, El Dorado, Ark.

HOPPERS & SPOUTS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind..

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Carnegie Chemical Mfg. Co., Los Angeles, Cal.
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

INSECTICIDES
American Agricultural Chemical Co., N. Y. C.
Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Commercial Solvents Corp., New York City
Milligan Bros., Jefferson, Iowa
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Powell & Co., John, New York City
Tennessee Products & Chem. Corp., Nashville Tenn.
Virginia-Carolina Chemical Corp., Richmond, Va.

IRON SULFATE
Tennessee Corp., Atlanta, Ga.

LEAD ARSENATE
American Agricultural Chemical Co., N. Y. C.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.

LIMESTONE
American Agricultural Chemical Co., N. Y. C.
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.
National Lime & Stone Co., Findlay, Ohio

LOADERS—Car and Wagon
Sackett & Sons Co., The A. J., Baltimore, Md.

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Atlanta Utility Works, The, East Point, Ga.
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MACHINERY—Acidulating
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Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.

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Bradley Pulverizer Co., Allentown, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
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Atlanta Utility Works, The, East Point, Ga.
Hayward Company, The, New York City
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MACHINERY—Mixing, Screening and Bagging
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

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Stedman Foundry and Machine Co., Aurora, Ind.

MANGANESE SULFATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corp., Atlanta, Ga.

MANURE SALTS
Potash Co. of America, New York City

MINOR ELEMENTS
Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
Tennessee Corporation, Atlanta, Ga.

MIXERS
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

NITRATE OF SODA
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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
International Min. & Chem. Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NITROGEN SOLUTIONS
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
Carnegie Chemical Mfg. Co., Los Angeles, Cal.
Lion Oil Company, El Dorado, Ark.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

NITROGEN MATERIALS—Organic
American Agriculture Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.
Spraying Systems Co., Bellwood, Ill.

PARATHION
American Cyanamid Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

PENTACHLOROPHENOL
Monsanto Chemical Co., St. Louis, Mo.

PHOSPHATE ROCK
American Agricultural Chemical Co., N. Y. C.
American Cyanamid Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
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PHOSPHORIC ACID
American Agricultural Chemical Co., N. Y. C.
Gen. Chem. Div., Allied Chem. & Dye., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.
Virginia-Carolina Chemical Corp., Richmond, Va.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
General Industrial Development Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.
Titlestad Corporation Nicolay, New York City

POTASH—Muriate
American Potash & Chemical Corp., N. Y. C.
Ashcraft-Wilkinson Co., (Duval Potash) Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, New York City
Southwest Potash Corp., New York City
United States Potash Co., N. Y. C.

POTASH—Sulfate
American Potash & Chemical Corp., N. Y. C.
International Min. & Chem. Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, Washington, D. C.

POTASSIUM PHOSPHATE
Monsanto Chemical Co., St. Louis, Mo.

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYROPHYLLITE
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
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SACKING UNITS
Sackett & Sons Co., The A. J., Baltimore, Md.

SCALES—Including Automatic Baggers
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SCREENS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SOIL TESTING APPARATUS
La Motte Chemical Products Co., Baltimore, Md.

SOIL CONDITIONERS
American Polymer Corp., Peabody, Mass.

SPRAYS
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Spraying Systems Co., Bellwood, Ill.

STORAGE BUILDINGS
Marietta Concrete Corporation, Marietta, Ohio

SULFATE OF AMMONIA
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
Inland Steel Co., Chicago, Ill.
Jackle, Frank R., New York City
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Lion Oil Co., El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Phillips Chemical Co., Bartlesville, Okla.
United States Steel Corp., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFATE OF POTASH—MAGNESIA
International Min. & Chem. Corp., Chicago, Ill.

SULFUR
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Texas Gulf Sulphur Co., New York City
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Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFUR—Dusting & Spraying
Ashcraft-Wilkinson Co., Atlanta, Ga.
U. S. Phosphoric Products Div., Tennessee Corp., Tampa, Fla.

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Ashcraft-Wilkinson Co., Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
Lion Oil Company, El Dorado, Ark.
Monsanto Chemical Co., St. Louis, Mo.
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Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Min. & Chem. Corp., Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

TALC
Ashcraft-Wilkinson Co., Atlanta, Ga.

TANKAGE
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
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TOXAPHENE
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Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

2, 4, 5-T
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Monsanto Chemical Co., St. Louis, Mo.

UREA & UREA PRODUCTS
Carnegie Chemical Mfg. Co., Los Angeles, Cal.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C

VALVES
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Crop Dusting at Grasslands Congress

Fertilizers, pesticides for

Grassland Program

THE virtually unexploited field of grasslands as a market for fertilizers and pesticides was brought vividly home to the farm chemicals industry at the recent Sixth International Grasslands Congress.

The Congress, held in the United States for the first time, was conducted at Pennsylvania State College, Aug. 17–23. A record 1200 delegates (from more than 50 countries) and more than 15,000 persons connected with agriculture and the farm chemicals industry attended the exhibitions and heard scores of talks on every facet of grassland farming—its advantages, methods and chemicals which are so vital to it.

Airplanes, like the one above, added a novel note to the meetings, laying down spray and dust in pest control demonstrations. One of the planes doing dusting also spread fertilizer. A control program against grasshoppers was interrupted, in fact, by one of two planes provided by the U. S. Bureau of Entomology and Plant Quarantine.

The world's foremost soil scientists and leaders in the field of grassland agriculture, who attended the meetings and exhibits were unanimous in recommending the intelligent use of chemical fertilizers and pesticides to insure healthy grass safe from the ravages of insects.

During the sessions of the Congress, three main reasons for grasslands were kept in the forefront: 1) a more balanced agricultural economy, 2) conservation of soil and water resources and 3) a more abundant production of meat and livestock products.

P. V. Cardon, president of the U.S.D.A. Graduate School, was elected new president of the Congress, which will meet next year in New Zealand. ◆

Information, Please

"AS AN industry, we are weak in economic and merchandising information."

That was one of the statements in the annual report of Lea S. Hitchner, executive secretary of the National Agricultural Chemicals Association.

He was addressing delegates attending the 19th annual convention in Spring Lake last month.

A discussion of the recent season of low sales and high inventories led to Hitchner's statement about merchandising. It points up a basic need in the industry—further exploration of the field so that new markets for farm chemicals (both pesticides and fertilizers) may be opened in occasional periods of sales slumps.

As the NAC secretary put it, much of the difficulty in selling pest control chemicals could have been avoided "if we had devoted just a fraction as much time, money and energy to studying the economic problems of the industry as we have devoted to chemical, entomological and pathological research."

Before offering some suggestions for preventingrecurrence of what he termed the "chaotic conditions" of the past year, Hitchner outlined the factors which he said had created the conditions.

These included the combination of high production stimulated by pressure from the defense agencies for both domestic and world requirements and an adverse growing season and relative lack of insect infestations.

Hence, according to Hitchner, a situation has temporarily been created which involves not only individual companies but the programs of pest control by government and private industry for 1952–53. He said it will affect production schedules, requirement estimates as prepared by the U.S.D.A., the export policies of OIT and other agencies of government and development programs of individual companies and some of the federal and state agencies.

Those are pretty far-reaching effects from a seasonal business slump, caused largely by weather conditions in the cotton south. Little wonder that the speaker was alarmed about the industry position. He went on to describe recent history of the pesticide business, with its years of high demand alternated frequently with adverse conditions, and stated that the basic issue facing the industry is the same today—"how to operate successfully under these conditions."

Hitchner declared the work of several years in promoting a "buy early" program had been wrecked by the slump, and called for the building of a sound program of distribution. He urged also that any marketing program which does not take into account what history can tell us about variations in insect infestations from year to year, problems of distribution and most of all the psychological factors which affect the cotton grower in planning pest control programs cannot long succeed.

THAT'S when Hitchner offered suggestions for preventing future slumps and stabilizing the industry. He said the following things are needed:

1. More statistics on production, inventory carryover, credits, federal and state recommendations and other economic signposts.

2. A better coordinated effort on the job of safe handling and use. "Unless this is done," the NAC official advised, "misguided critics will curtail seriously the use of many materials."

3. New markets for our products, some of which offer possibilities far in excess of uses now recognized as common practice. Hitchner included the widely publicized grassland program, the stored grain program, forest pest control programs and the world export market.

These suggestions are of great importance to the pesticide industry. In addition, nearly all apply to fertilizer industry personnel.

In closing his address, Hitchner noted that various state and federal agencies and interested private groups will be promoting these programs, but that "industry should not be content merely to ride on their efforts."

We think Hitchner has some provocative suggestions for the whole farm chemicals industry in its efforts to level off the hills and dales of its year-to-year economic situation.

—HAMILTON C. CARSON

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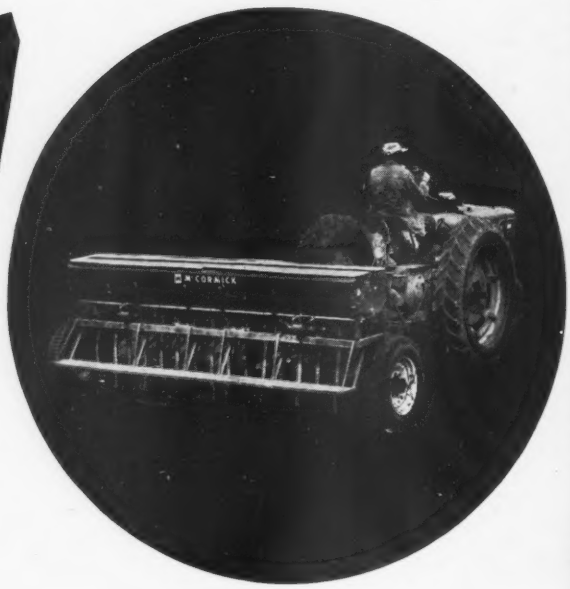

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